

## **9450 DIGITAL OSCILLOSCOPE**

### **SERVICE MANUAL**

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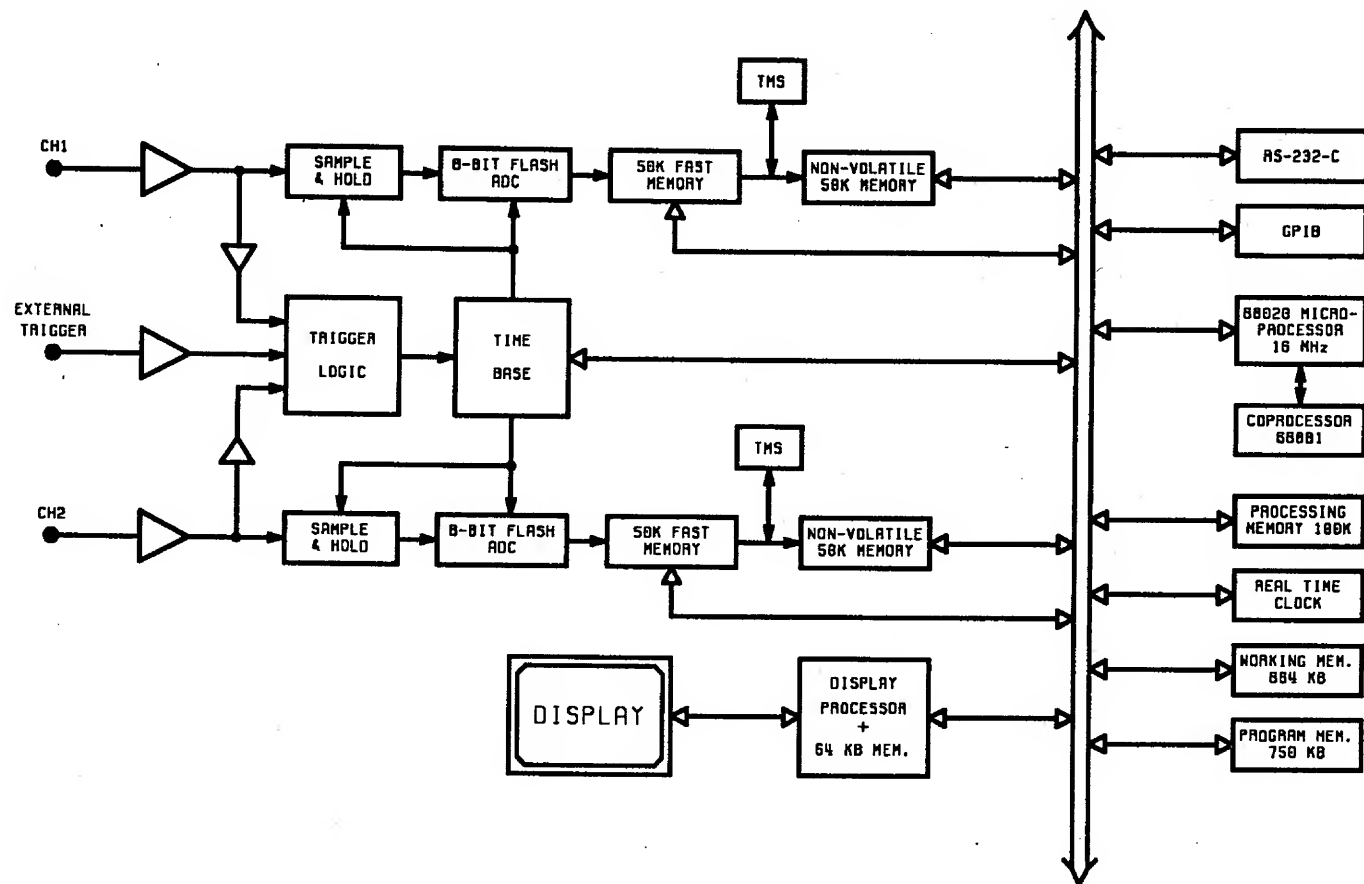
## **INDEX**

- Specifications
- Basic Operation and Block Diagrams
- Basic Performance Test Procedure  
and  
Internal Diagnostics and Calibration
- Service Information and Procedures
- Mechanical Drawings
- Circuit Diagrams
- Parts List

## **SPECIFICATIONS**

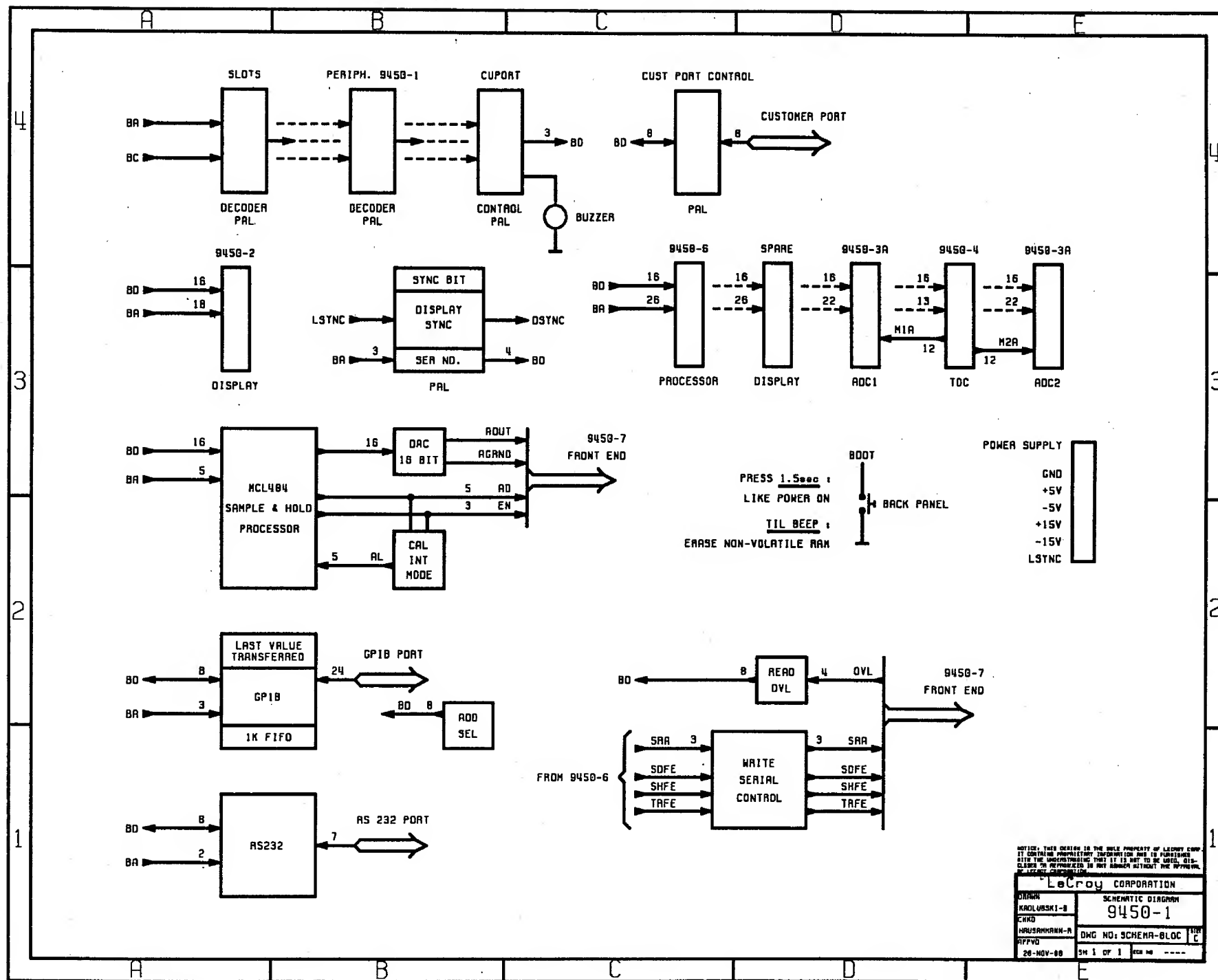
**BASIC OPERATION  
AND  
BLOCK DIAGRAMS**

# 9450 HARDWARE OVERVIEW



## 9450 SUB-ASSEMBLIES

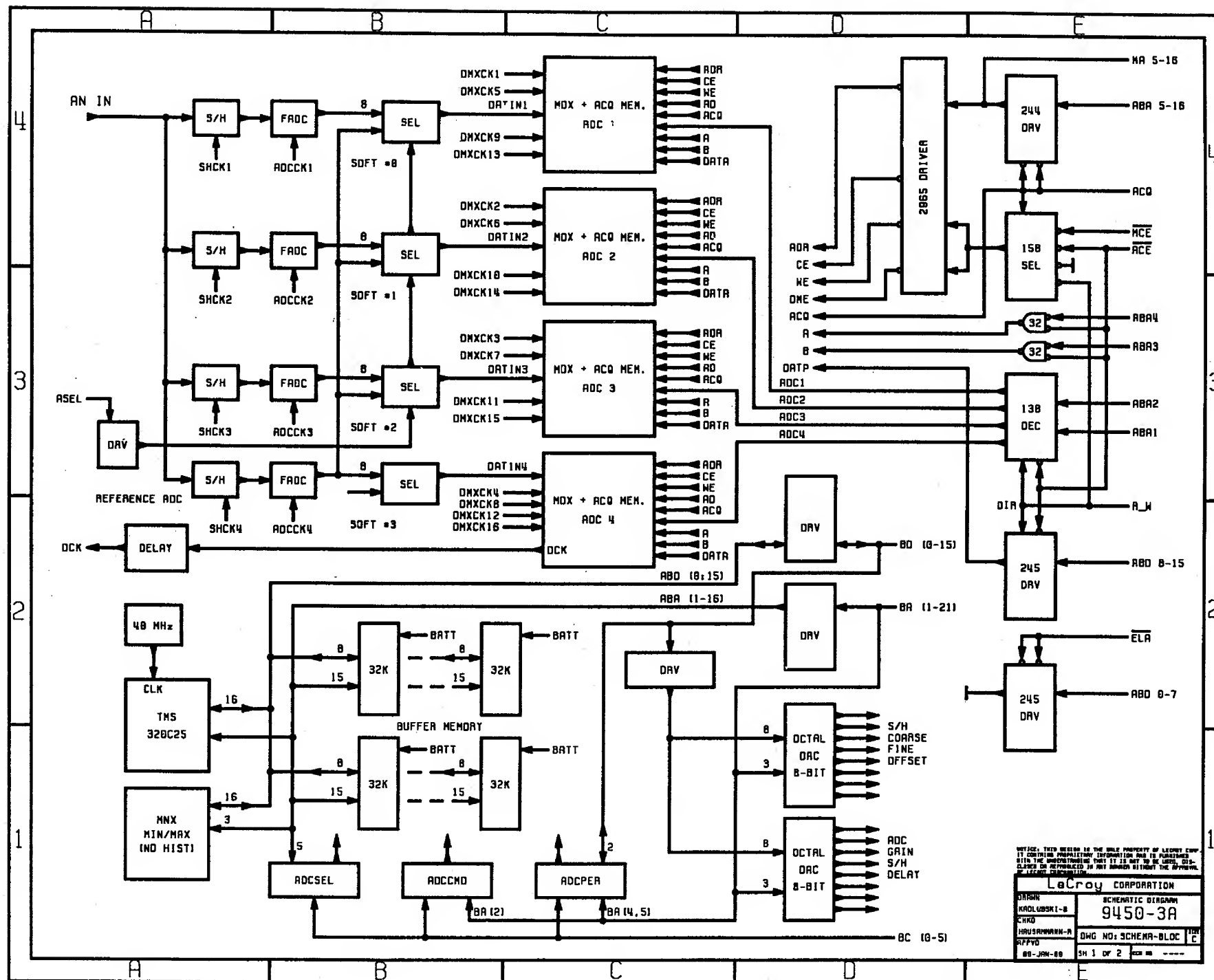
9450-1	Base Board
9450-2	Display
-3A	ADC
-4	Time base
-5	Front panel
-6	Processor (compatible with 9420-6)
-7	Front-end
-8	Clock bus
9451-1	Power supply

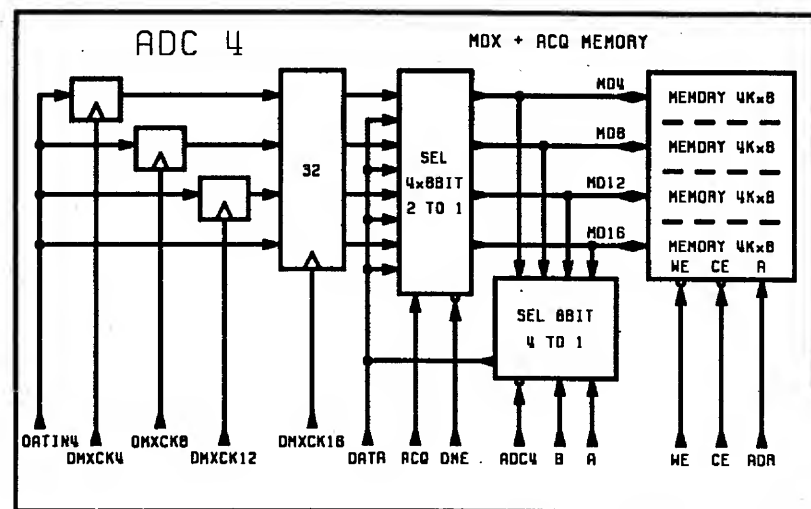
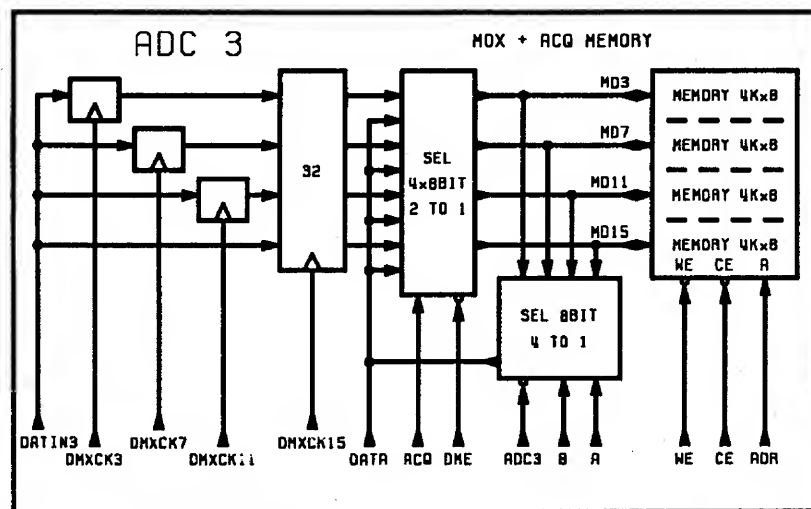
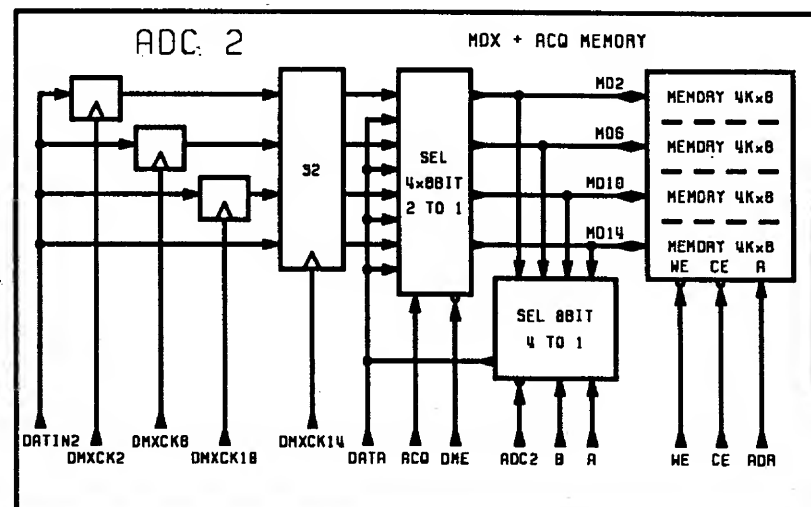
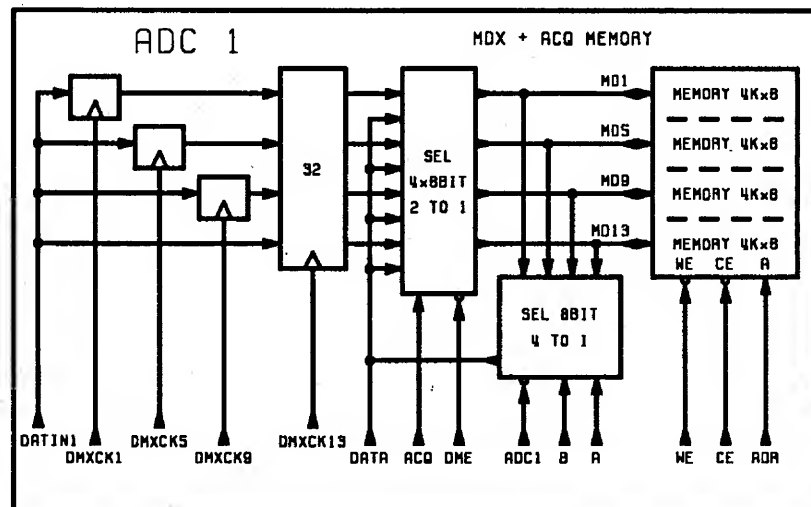


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LeCroy CORPORATION	
DESIGN	SCHEMATIC DIAGRAM
KADLASKI-B	9450-1
CARD	
HAUSMAN-R	DWG NO: SCHEM-BLOC 1
APPROV	26-NOV-88 3M 1 OF 1 REV NO ----



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LeCroy CORPORATION	
DRAWN G.S.B. CIND G.S.B. APP'D G.S.B. DA	SCHEMATIC DRAWING 9450-2 QWG NO: 9450.2 SH 1 OF 1 DEC 1980

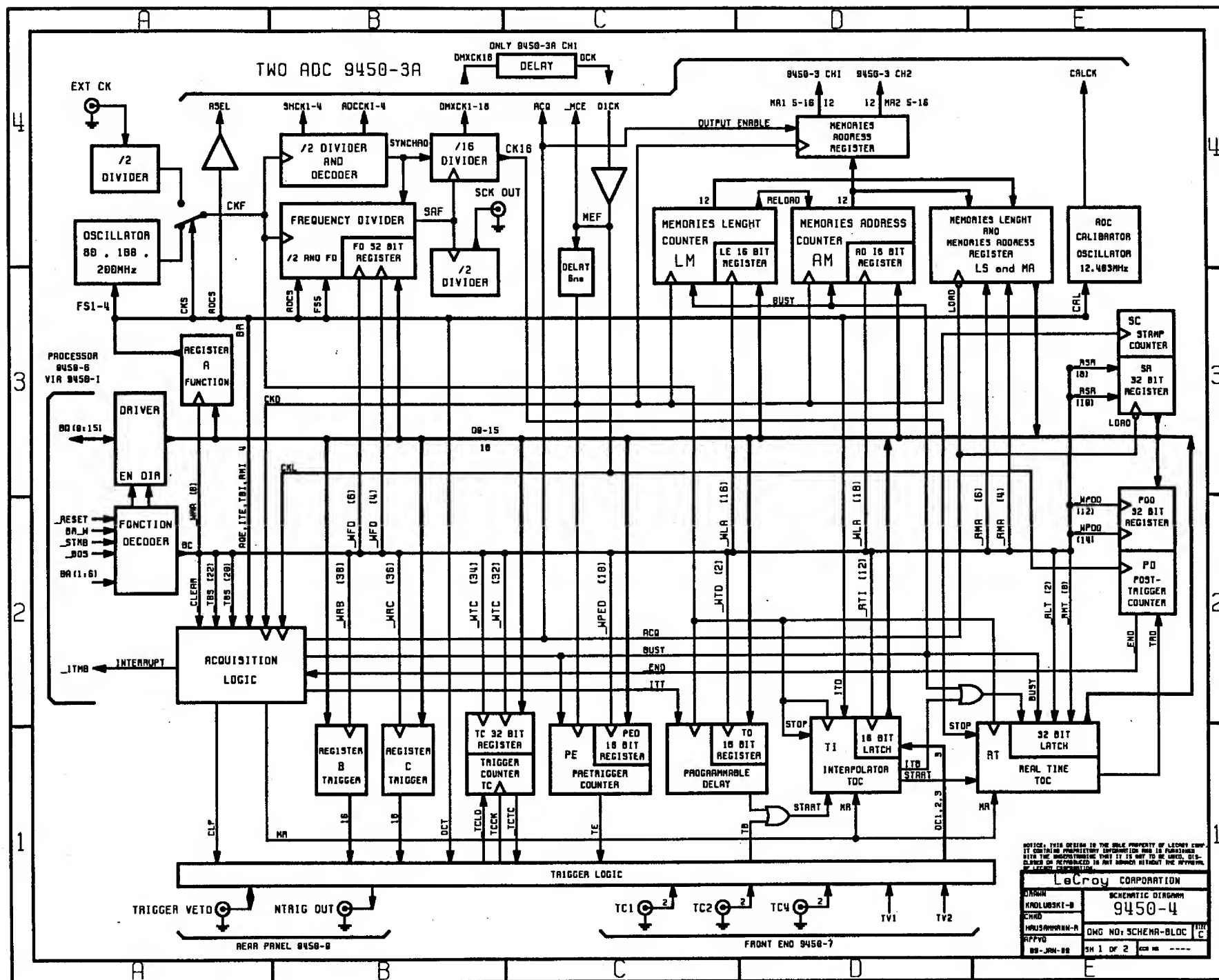




### ADC Numbering Scheme

	HARD	SOFT (Internal Diag)
Reference ==>	4	3
First in time ==>	1	0
	2	1
	3	2

The reference ADC is used in Single-ADC Sampling Mode.

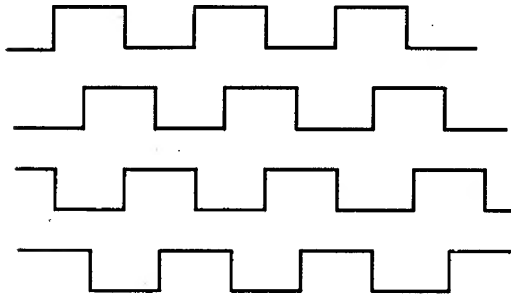




SAMPLING CLK TIMING



INT OSC  
80 / 100 / 200 MHz

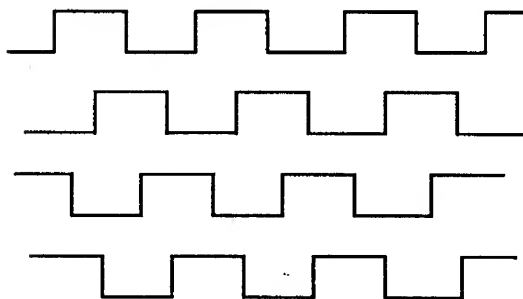


S/H # 1

2

3

4



ADC # 1

2

3

4

# 9450 SAMPLING CLOCK RATES vs TIME/DIV

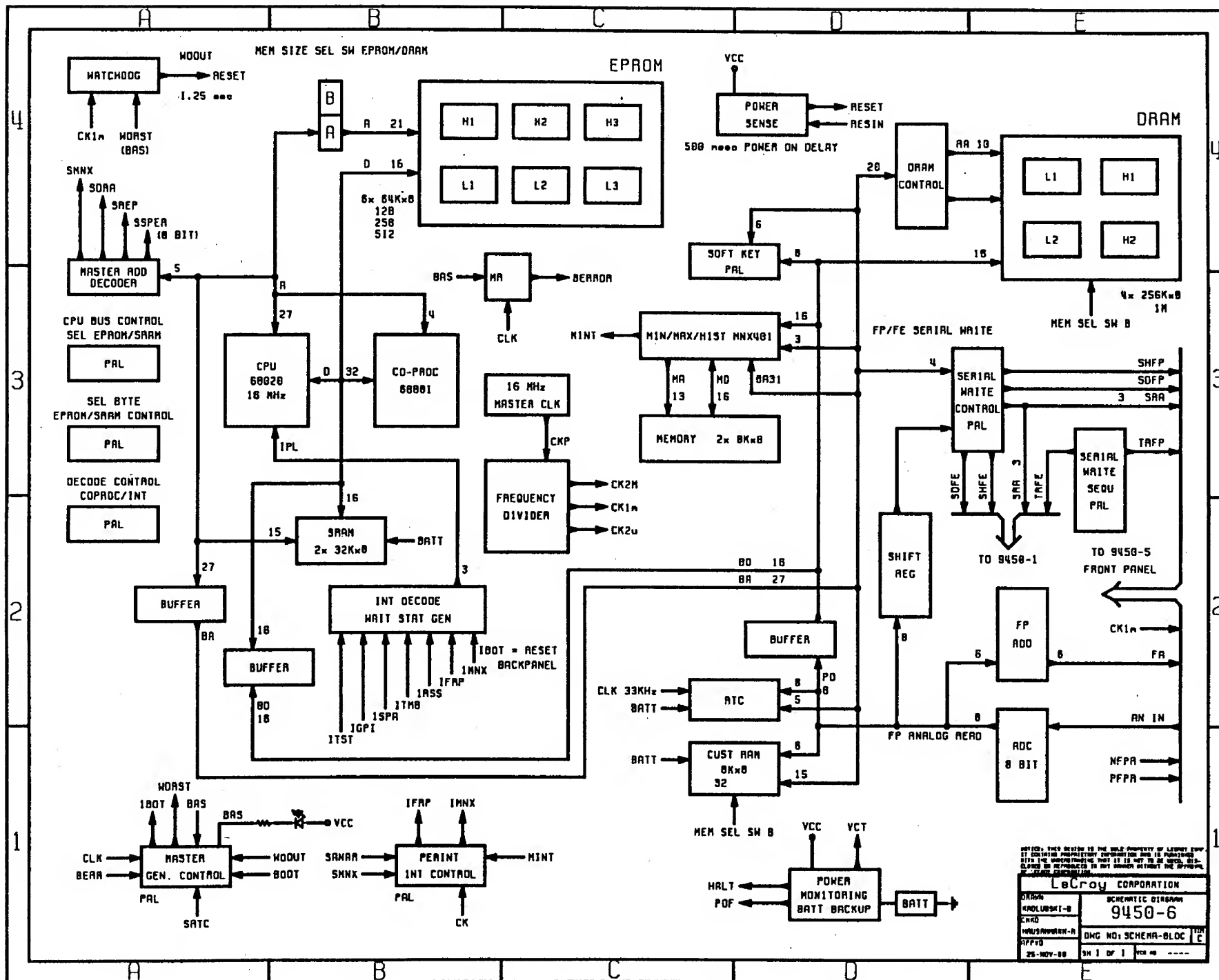
## Single-shot:

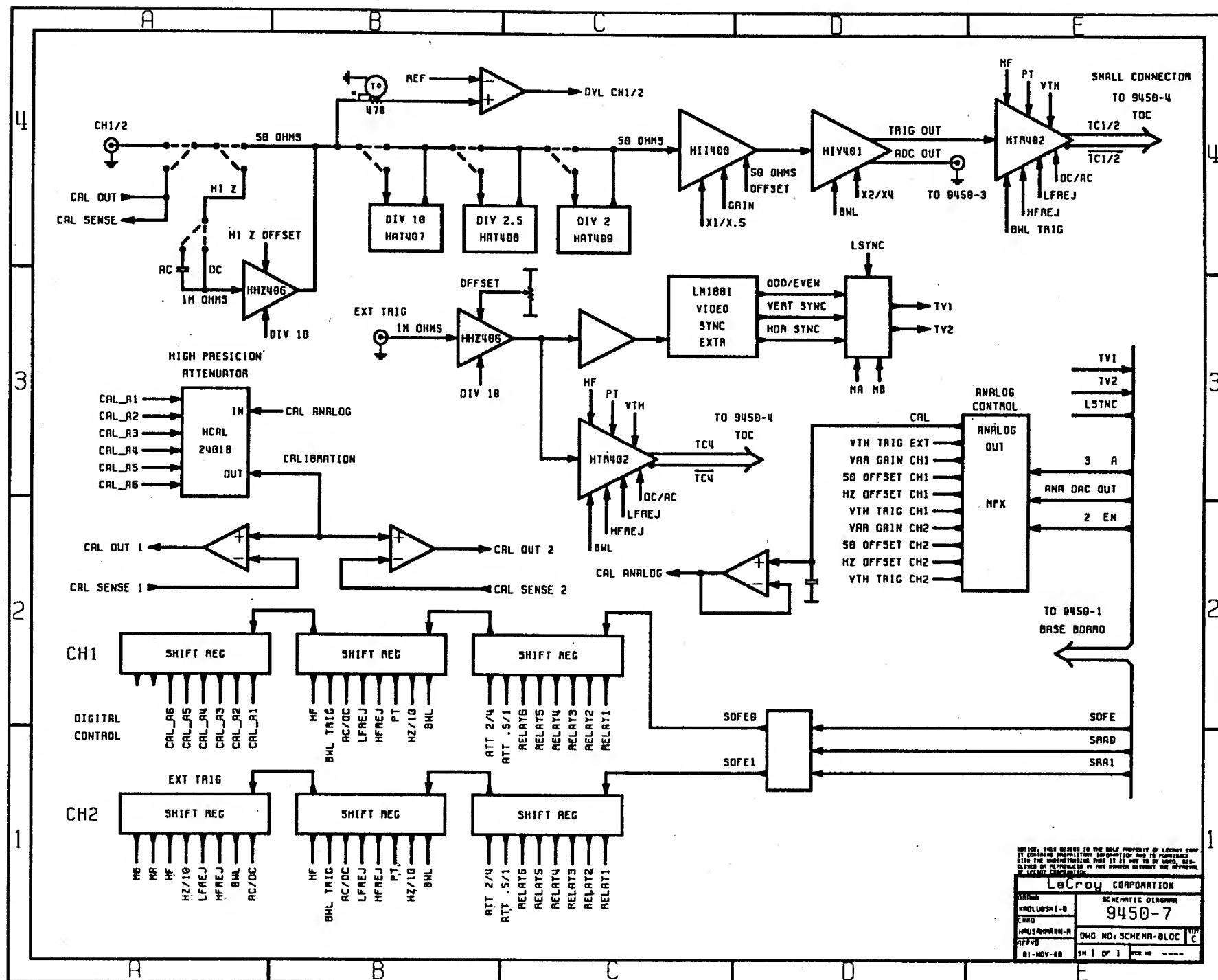
INT OSC MHz	Sampl Rate Ms/sec	Sample Intvl nsec	S/H CLK MHz	# ADC	Time/div
200	400	2.5	100	4	10 nsec
.	.	.	.	.	.
100	200	5.0	50	4	20 $\mu$ sec
200	100	10.0	100	1	50 $\mu$ sec
80	40	25	40	1	.1 msec
80	20	50	40	1	.2 msec
80	10	100	40	1	.5 msec
80	4	250	40	1	1 msec
80	2	500	40	1	2 msec
80	1	1000	40	1	5 msec
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
80	1 Hz	1 sec	40	1	5 ksec

## RIS:

INT OSC MHz	Sampl Rate Ms/sec	Equiv Rate Gs/sec	Sampl Intvl	S/H CLK MHz	# ADC	Time/div
200	100	10	100 psec	100	1	1 nsec
.	.	.	.	.	.	.
200	100	4	250 psec	100	1	1 $\mu$ sec
200	100	2	500 psec	100	1	2 $\mu$ sec
200	100	1	1 nsec	100	1	5 $\mu$ sec







<div><div>50 Ω</div><div><div>HAT 407</div><div>HAT 408</div><div>HAT 409</div><div>HII 400</div><div>HIV 401</div></div><div><div>÷10</div><div>÷2.5</div><div>÷2</div><div>x 2</div><div>÷2</div><div>x 2</div><div>÷2</div><div>x 2</div><div>BWL</div></div></div>																
RANGE [mV]	FS [mV]	OFFSET 10v = 600 mV				HII 400 input /56Ω				HII 400 output /37.5 Ω				HIV 401 output/25 Ω	GAIN	
5	40	± 600 mV				± 20		± 40	OFF	± 40		± 80	OFF	± 80	± 160 mV	8 x
10	80	± 300 mV				± 40		± 80	OFF	± 80		± 160	ON			4 x
20	160	± 150 mV				± 80		± 160	ON	± 80						2 x
50	400	± 375 mV		ON												0.8
100	800	± 750 mV		ON	ON											0.4
200	1600	± 1500 mV	ON													0.2
500	4000	± 3750 mV	ON	ON												0.08
1000	8000	± 7500 mV	ON	ON	ON											0.04

<div> <div>HZ ÷ 10</div> <div>HZ out</div> </div>															
50	400	OFF	± 200	OFF	ON		± 80								
100	800	OFF	± 400		ON	ON	± 80			± 80			± 80	± 160	
200	1600	ON	± 80				± 80			± 80			± 80	± 160	
500	4000	ON	± 200		ON		± 80			± 80			± 80	± 160	
1000	8000	ON	± 400		ON	ON	± 80			± 80			± 80	± 160	

## MODEL 9451-1 POWER SUPPLY

### Specifications

Input voltage:	90 to 132 V <sub>AC</sub> , 180 to 264 V <sub>AC</sub> , selected by the user
Input frequency:	45 to 440 Hz
Inrush current:	max. 10 A at start-up
Operating temperature range:	0° C to 65° C at full load
Hold-up time:	min. 20 msec, at full load and minimal input
Conducting EMI:	VDE 0871 curve B, IEC 801
Isolation:	VDE 0411/0730/0804/0806, IEC 348/380/435 3750 V <sub>AC</sub> , 4000 V <sub>DC</sub> input lines to ground leakage current <5 mA <sub>AC</sub> , 50 Hz
Input over-voltage protection:	yes
Outputs:	four, with common return (ground)
Output voltage:	out 1, +15 V: +15.00 V $\pm$ 1%, nom. 3.2 A <sub>RMS</sub> out 2, -15 V: -15.04 V $\pm$ 1%, nom. 3.8 A <sub>RMS</sub> out 3, +5 V: +5.07 V $\pm$ 1%, nom. 8.6 A <sub>RMS</sub> out 4, -5 V: -5.16 V $\pm$ 1%, nom. 10.8 A <sub>RMS</sub>
Output voltage adjustment:	min. $\pm$ 5%
Output over-voltage protection:	no
Line regulation:	max. 0.1% at any load
Output voltage regulation:	+15 V and -15 V: $\pm$ 1% 1.5 A to 4.5 A load +5 V: $\pm$ 1% 6 A to 11 A load -5 V: $\pm$ 1% 9 A to 13 A load
Transient response (100 Hz):	+15 V and -15 V: <0.5 V, 500 $\mu$ sec: 2 A to 4.5 A + 5 V: <0.2 V, 500 $\mu$ sec: 6 A to 11 A

Output ripple and noise:

+15 V and -15 V: max. 100 mV<sub>pp</sub> (100 MHz)

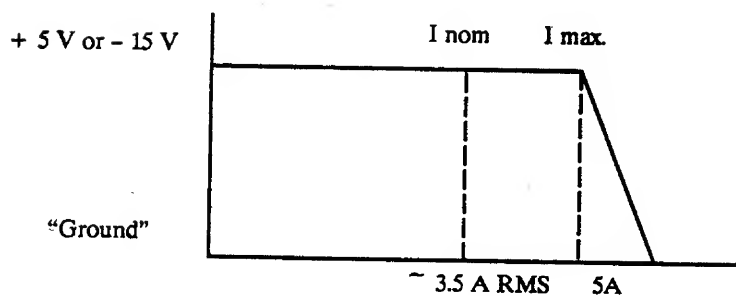
+5 V and -5 V: max. 80 mV<sub>pp</sub> (100 MHz)

50 Hz output ripple:

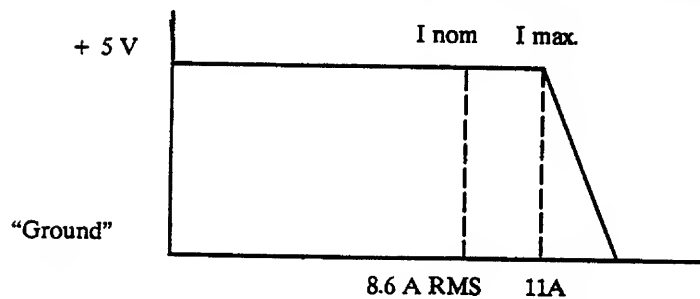
max. 5 mV

Maximum output current:

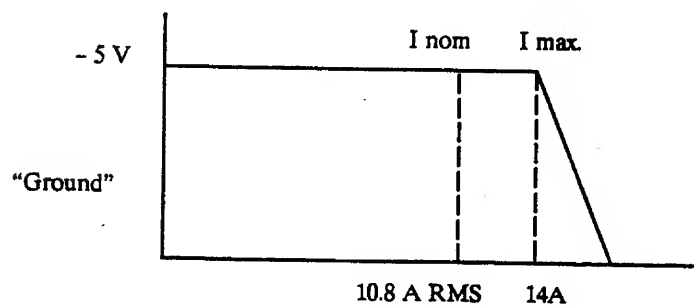
+ 15 V and - 15 V:  $I_{\max} = 5 A_{+1}^{-0}$



+ 5 V :  $I_{\max} = 11 A_{+2}^{-0}$

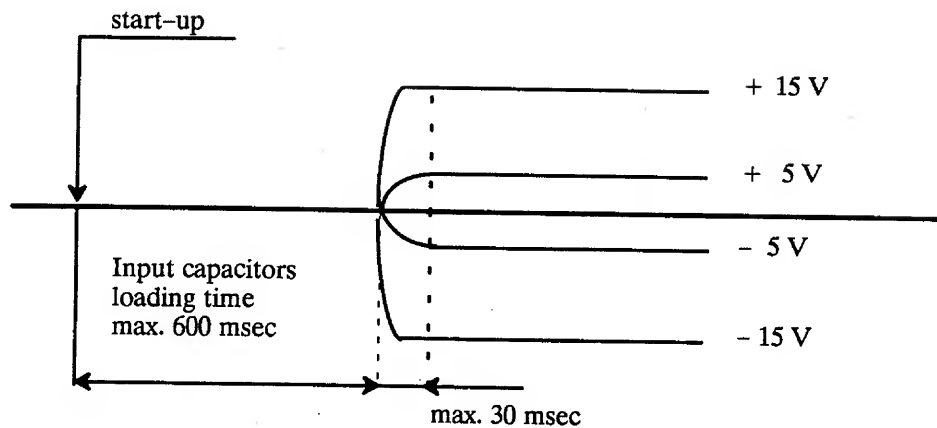


+ 5 V :  $I_{\max} = 14 A_{+2}^{-0}$



Max. output current adjustment: min.  $\pm 20\%$

Soft-start: input 90 V<sub>AC</sub>, 45 Hz: outputs I<sub>nominal</sub>



Power output: nominal 204 W

maximum 240 W

Line sync output: square signal, duty cycle 50%, 45 to 440 Hz

levels: 0 = 0 V , 1 = +5 V

rise and fall time <100 nsec

isolation: line-line sync output 2.5 kV<sub>AC</sub>

Fan power supply output: 15 V<sub>DC</sub>, max. 0.15 A

Safety: designed to meet the following international safety requirements:

VDE 0411/0730/0804/0806, IEC 348/380/435

Line input connector: CEE 22/VI (XIV), ASE type 113

X2 Base card connector:

header 10 pins 94V0 material

AMP

pin assignment

1: positive line sync

2: common return

3 to 5: +5 V

7 to 8: -5 V

4 to 6: common return

9: +15 V

10: -15 V

X3 display cord connector:

header 3 pins, 94V0 material

AMP 350789-1

pin assignment

1: -15 V, with fuse slow 2 A

2: common return

3: +15 V, with fuse slow 2 A

X1 Fan connector:

header 2 pins, 94V0 material

AMP 350786-1

pin assignment

1: common return

2: +15 V

Probe power connector:

two, located on the switchboard

LEMO RA 0304 N

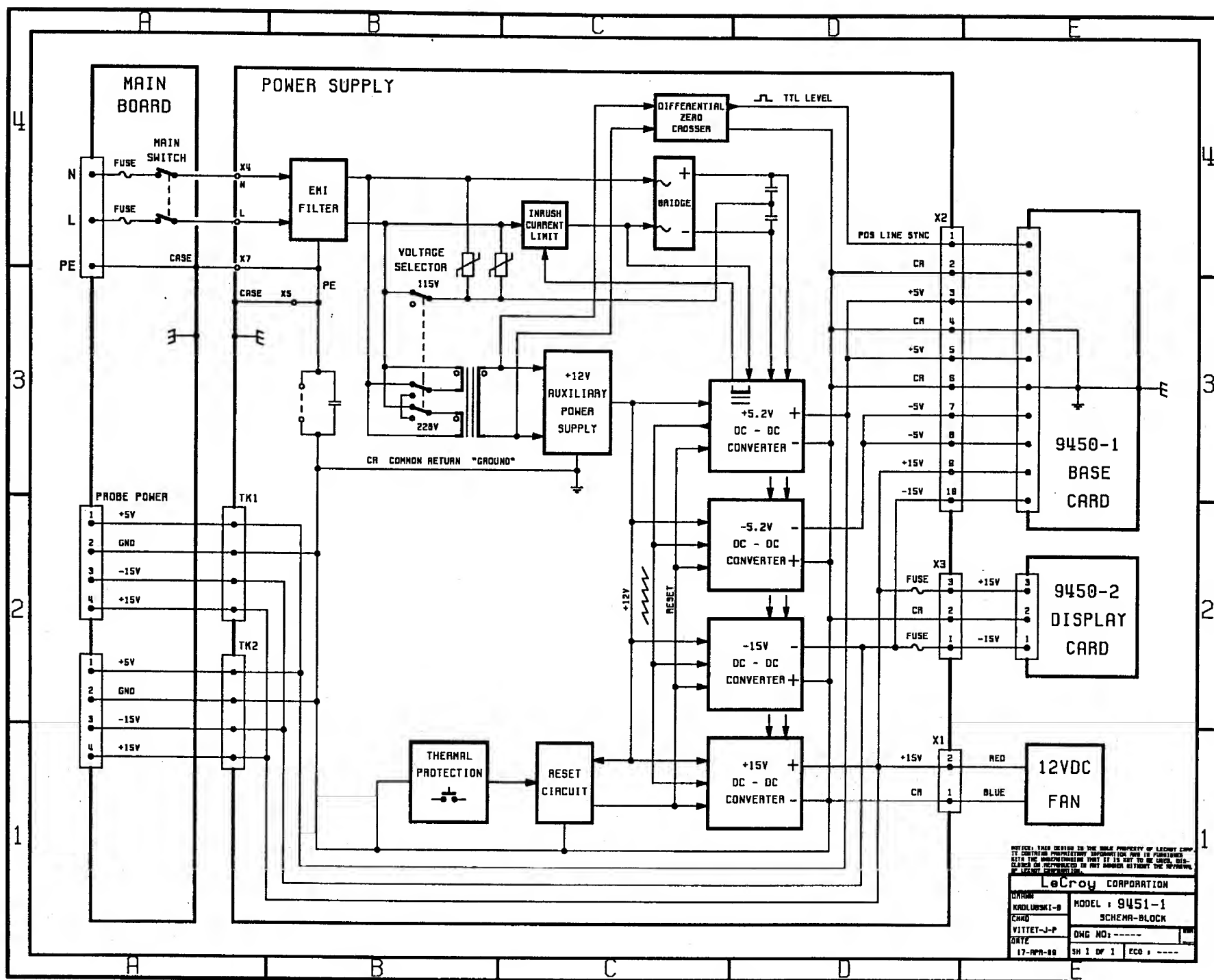
pin assignment

1: +5 V

2: ground, common return

3: -15 V

4: +15 V





**BASIC PERFORMANCE TEST PROCEDURE**  
**AND**  
**INTERNAL DIAGNOSTICS AND CALIBRATION**

## **BASIC PERFORMANCE TEST PROCEDURE FOR THE 9450 DIGITAL OSCILLOSCOPE**

### **1 Turn-On**

Before switching on the digital oscilloscope (DSO), check that the correct line voltage is set at the rear-panel power selector. Switch on the power using the power switch on the rear panel. Then check:

- that the display turns on after about 10 seconds
- that the display is stable
- that the range of INTENSITY and GRID INTENSITY is reasonable

Wait for about 20 minutes for the scope to reach a stable operating temperature.

### **2 Noise on the Inputs**

This is to verify the proper operation of all front-end components. With no signal connected to the inputs, set the DSO as follows:

- turn on traces CH1 and CH2
- Grid: single
- Input couplings CH1 and CH2: 1 M $\Omega$  DC
- Input gain: 5 mV/div
- Trigger:
  - SMART (COMPLEX) Trigger: OFF
  - Source: LINE
  - Coupling: AC
  - Mode: NORM
- Time/div: 10 msec/div
- BWL: OFF

Check:

- displayed waveforms should have a constant band of less than 3 minor divisions
- there is no discernible periodic structure

Repeat the test for Time/div = 5 msec/div, 2 msec/div, 1 msec/div, and .5 msec/div and check as above.

### 3 Test of the ADCs

This is to verify proper operation of the ADCs at the four nominal sampling frequencies: 400, 200, 100, and 40 Ms/sec.

With both Channel 1 and Channel 2 inputs open, set the DSO as follows:

- turn on the CH1 trace
- Grid single
- Input couplings CH1 and CH2: 1 M $\Omega$  DC
- Input gain 50 mV/div
- Trigger:

SMART (COMPLEX) Trigger: OFF  
Source: LINE  
Coupling: AC  
Mode: NORM

- Time/div = 10, 20, 50, 100  $\mu$ sec/div

For each of the four time bases above, check for CH1 and CH2:

- displayed waveform should lie within a band of less than 3 minor divisions
- Using the offset control move the trace for CH1 and CH2 slowly through the entire range and check that there is no significant change in the displayed trace. Repeat for channel 2.

### 4 Offset

Set the DSO as follows:

- turn on the trace for CH1
- Grid single
- Input set to GND
- Input gain 5 mV/div, offset zero
- Trigger:

SMART (COMPLEX) Trigger: OFF  
Source: LINE  
Coupling: AC  
Mode: NORM

- Time/div = 50  $\mu$ sec/div
- BWL OFF

Switch between 50  $\Omega$  DC and GND, and 1 M $\Omega$  DC and GND.  
Check:

- the trace should not move more than a minor division or 1 mV

Repeat the same test for CH2.

## 5 Input Impedance

Set the DSO CH1 input to 1 M $\Omega$  DC with any time base and gain.  
Check with an ohmmeter:

- input impedance must be 1 M $\Omega \pm 2\%$

Set DSO CH1 input to 50  $\Omega$ , 20 mV/div with any time base.  
Check:

- input impedance must be 50  $\Omega \pm 2\%$

Repeat 50  $\Omega$  test for 50, 100, 200, 500 and 1000 mV/div.

Repeat all impedance checks for CH2.

## 6 Front-End

Set the DSO as follows:

- turn on the trace for CH1
- Grid normal
- Input 50  $\Omega$ , gain 100 mV/div, offset zero
- Trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	CH1
Coupling:	DC
Mode:	NORM
Delay:	50%
Level:	zero

- Time/div = .1  $\mu$ sec/div
- BWL OFF

Apply a 600 mV peak-to-peak 1 MHz square wave from a fast (less than 1 nsec) risetime function generator (for example TEK PG502) to CH1 input. Press the Interleaved Sampling button on the oscilloscope to turn on the RIS mode.

Check:

- There should be no large over-shoot at the rising and falling edge:  
50  $\Omega$ : less than 10% overshoot
- Check the same at 10 mV/div, input 60 mV peak-to-peak
- Repeat the above for CH2, trigger source CH2

## 7 Internal Diagnostics and Calibration

The 9450 Internal Diagnostics and Calibration menu is entered by pressing the "Main Menu" button while keeping the lowest menu button depressed. To quickly check the performance of the scope, press the 'CALIBRATION Constants' button and then press 'Full Recalibration'. It is advisable to perform this type of check when the scope is in a stable condition after about 20 minutes of warm-up. Then enter 'Calibration Error Log' and you get a comprehensive summary of the scope's calibration status. If all the error status codes are zero, it is very likely that everything is OK, except for the linearity which is best checked by 'Chan 1+2 Full Test'. If you find error codes different from zero, you can find more information on the problem from the other 'Constants' menus or from the various 'Curves' menus. Before we turn to a description of the menus relevant to service, let us give the interpretation of the calibration error log.

### 7.1 Calibration Error Log

This is a handy tool to perform a quick and comprehensive internal performance check, without touching the acquisition settings. Just push 'Full Recalibration', then go to 'Calibration Error Log'. The result displayed is independent of your current time base, sensitivity and other acquisition settings. The conditions to be tested are set automatically during the recalibration. The error conditions are coded into binary bits, i.e. each bit set represents a certain error. The error status is represented in a hexadecimal number (4 bits = 1 nibble) for each acquisition condition, see Figure 1.

27-Apr-89  
15:31:30

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CALIBRATION ERROR LOG			
Chan 1+2 Calib Const	Vertical Calibration		
	4 nibbles=(BWL OFF,50Ω) (OFF,1MΩ) (ON,50Ω) (ON,1MΩ) (8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)		
Chan 1+2 Full Test		CHAN1	CHAN2
	5 mV	0	0
	10 mV	0	0
	20 mV	0	0
	50 mV	0	0
	.1 V	0	0
	.2 V	0	0
Full Re- calibration	.5 V	0	0
	1 V	0	0
	TMS Status	Working	Working
Calibration Error Log	4 nibbles = (400Ms) (200Ms) (100Ms) (40Ms)		
More Consts	Trigger Cal.	0	0 (2=No BWL, 1=BWL)
	Leveling Cal.	0	0 (2=Offset, 1=Gain Conv.)
	Phase Cal.	0	0 (4=Limits, 2=Fit, 1=Conv)
Return	TDC Calibration		0

Figure 1: Calibration Error Log

Vertical Calibration:

BWL ON/OFF and 50/1M input coupling makes 4 acquisition conditions per channel. The error status of each is represented by a nibble as explained on the display. The 4 error bits have the following meaning:

- 1=gain convergence: One or more of the 8 nominal DAC calibration points cannot be reached.
- 2=gain range: A multiplicative calibration parameter becomes too small (dgain < 0.95) such that there may not be sufficient variable gain.
- 4=offset convergence: One or more of the nominal points to calibrate the offset DAC cannot be reached.

8=offset range:           The calibration found may go out of DAC range for certain offset values chosen (this problem should never occur at 5/10 mV)

Examples:

Code 303:   Gain range and gain conv. problem at 1 M $\Omega$ , BWL ON and OFF

Code 4c6d:   Offset conv. problem on all 4 coupling conditions  
          Offset range problem at 1 M $\Omega$  BWL ON and OFF  
          Gain range problem at 50  $\Omega$  BWL ON  
          Gain conv. problem at 1 M $\Omega$  BWL ON

TMS status: Status must be 'working'. 'No memory' is indicated if the ADC board is not present. Other fatal messages may come up, like 'TMS Broken'.

The following tests report problems for each of the 4 possible sampling rates:

Ms/sec	400	200	100	40
$\mu$ sec/div	$\leq 10$	20	50	$\geq 100$
Int. osc. MHz	200	100	200	80
Number of ADC used	4	4	1	1

When sampling with one ADC, the reference ADC (No. 3 by soft. Wave numbered 0, 1, 2, 3 for software, 1, 2, 3, 4 for hardware) is used. RIS mode runs always at 100 Ms/sec with 1 ADC.

Trigger Calibration:

1=BWL ON  
2=BWL OFF

Example:

Code 3311:   Problem at BWL ON for all 4 sampling rates.  
          Problem BWL OFF at 400 and 200 Ms.

### Leveling Calibration:

This part of the calibration levels all ADCs to reference ADC No. 3 (which is always at 80). For this it adjusts the offsets and gains associated to each S/H and ADC, respectively. The procedure may encounter the following problems:

- 1=gain convergence: ADC gain correction not possible for one or more ADCs.
- 2=offset: Offset cannot be adjusted for one or more ADCs.

### Phase Calibration:

This part aligns the 4 S/Hs in time to better than 20 psec by an iterative procedure. There is no need to go into more detail. The error code should be zero. However, for the moment 1s may appear on some units. It is acceptable for the time being, as correct operation is not impaired by this.

### TDC Calibration:

The Interpolating TDC is calibrated at 40, 100 and 200 Ms/sec. If it is OK, error code is equal to zero.

### Examples:

Leveling Cal. Code 2300: Offset problem at 400 and 200 Ms  
Gain conv. problem at 200 Ms

That's all that is required for a quick but complete internal check of the scope. If there remain error codes (not equal to zero) the following menus may be used to get more detailed information on possible problems and failures.

## 7.2 Chan 1+2 Full Test

The DC non-linearity is analyzed automatically for BWL ON/OFF, 50/1M $\Omega$  coupling and both channels for the sampling rate you have set. The last two lines at the bottom of the table list the largest non-linearities found for 5 mV/div and all other gains. The test should be done for the 4 possible sampling rates 40, 100, 200 and 400 Ms/sec, i.e. for time bases 100, 50, 20 and 10  $\mu$ sec/div. However, the current sampling rate is not displayed. In order to change the rate, one has to leave the menu and set the time/div appropriate to the required sampling rate, see table in 7.1. The non-linearities should not be larger than 3% for 5 mV/div, and 2% for > 5 mV/div, see Figure 2.



27-Apr-89  
16:10:15

LeCroy

18:10:18

FULL DC NON-LINEARITY ANALYSIS Srate 400Ms/s

Chan 1+2	CH1				CH2			
Calib Const	BW-Limit	OFF	ON		OFF	ON		
	50 $\Omega$ : Max. Deviations (in %)							
	5 mV	-.5/ .4	-.4/ .4		-.2/ .5	-.2/ .6		
	10 mV	-.6/ .5	-.4/ .7		-.8/ .1	-.4/ .6		
	20 mV	-.7/ .9	-.6/ .4		-.9/ .1	-.5/ .7		
	50 mV	-.7/ .2	-.6/ .4		-.8/ .1	-.4/ .6		
	.1 V	-.7/ .2	-.6/ .3		-.8/ .2	-.6/ .3		
	.2 V	-.8/ .2	-.6/ .3		-.9/ .2	-.5/ .3		
	.5 V	-.7/ .3	-.5/ .3		-.8/ .2	-.5/ .4		
	1 V	-.5/ .4	-.4/ .5		-.5/ .4	-.5/ .5		
	1 M $\Omega$ : Max. Deviations (in %)							
	5 mV	-.2/ .8	-.2/ .5		-.4/ .3	-.4/ .4		
	10 mV	-.2/ .4	-.5/ .1		-.6/ .1	-.5/ .2		
	20 mV	-.6/ -.0	-.4/ .1		-.5/ .2	-.4/ .2		
	50 mV	-.5/ .1	-.4/ .1		-.6/ -.1	-.5/ .1		
	.1 V	-.0/ .6	-.4/ .2		-.7/ .0	-.5/ .2		
	.2 V	-.7/ -.0	-.5/ .2		-.6/ .2	-.5/ .3		
	.5 V	-.6/ .1	-.5/ .2		-.6/ .0	-.6/ .2		
	1 V	.0/ .7	-.5/ .2		-.6/ -.0	-.5/ .1		
	Summary							
	5mV	**	-0.5/ 0.8	**	**	-0.4/ 0.6	**	
	> 5mV	**	-0.8/ 0.7	**	**	-0.9/ 0.7	**	

Figure 2: CH 1+2 Linearity Analysis

### 7.3 Chan 1+2 Gain Curves (optional)

The variable gain curve is displayed for both channels for the acquisition parameters set. The center line is at inverse gain 1.75 (e.g. 1.75 V/div total gain for fixed gain at 1 V/div) and vertical units are 0.25/div. So the top border is at 2.75 and the bottom at 0.75. Horizontally the curve goes from DAC -8 V at the left to 0 V at the right. The curves should be smooth and go well above the inverse gain 2.5 and 1.0 limits indicated, where the variable gain is at .4 and 1., see Figure 3.

20-Apr-89  
16:00:09

erate 400Ms/s bwl OFF Ch 1: 10 mV 50 Ch 2: 10 mV 50 LeCroy

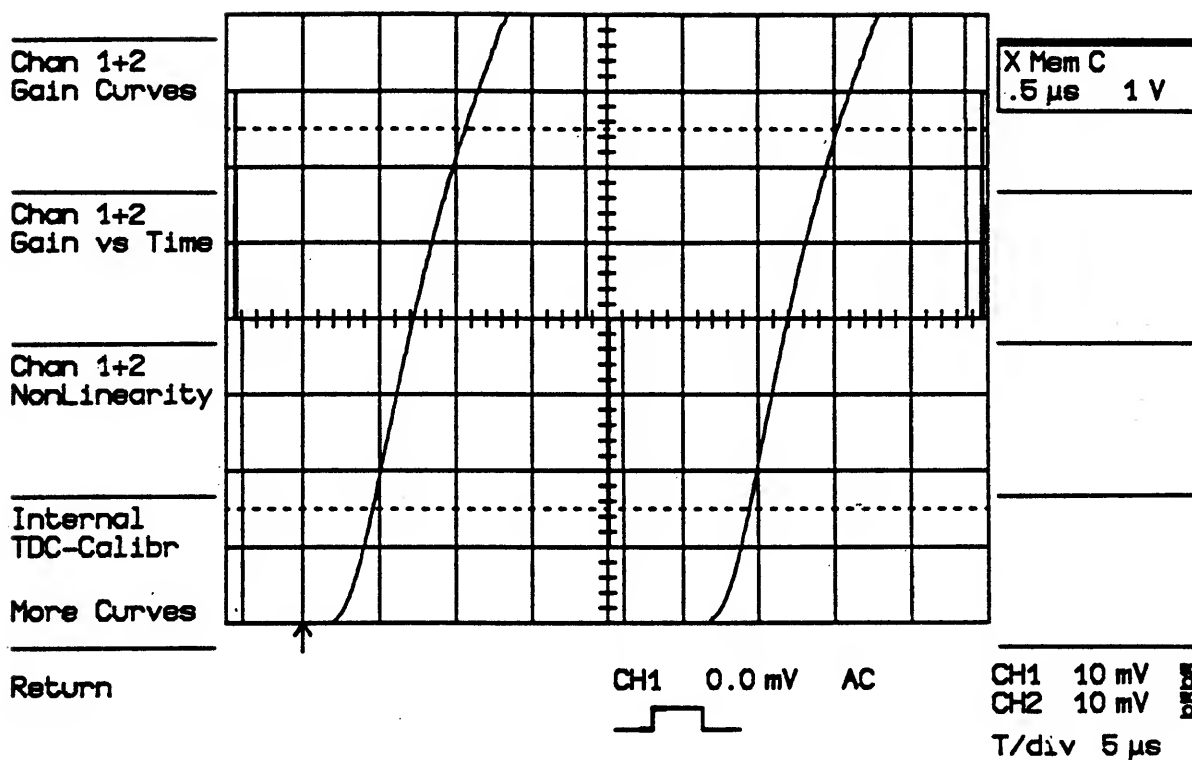


Figure 3: CH 1+2 Gain Curves

#### 7.4 Chan 1+2 Gain vs Time (optional)

The gain variations over time are displayed for both channels for the acquisition parameters set. One vertical div is 0.5%. At present, the variations should stay within  $\pm 3\%$ , see Figure 4.

20-Apr-89  
16:13:00

srata 400Ms/s bwl ON Ch 1: 10 mV 50 Ch 2: 10 mV 50 LeCroy

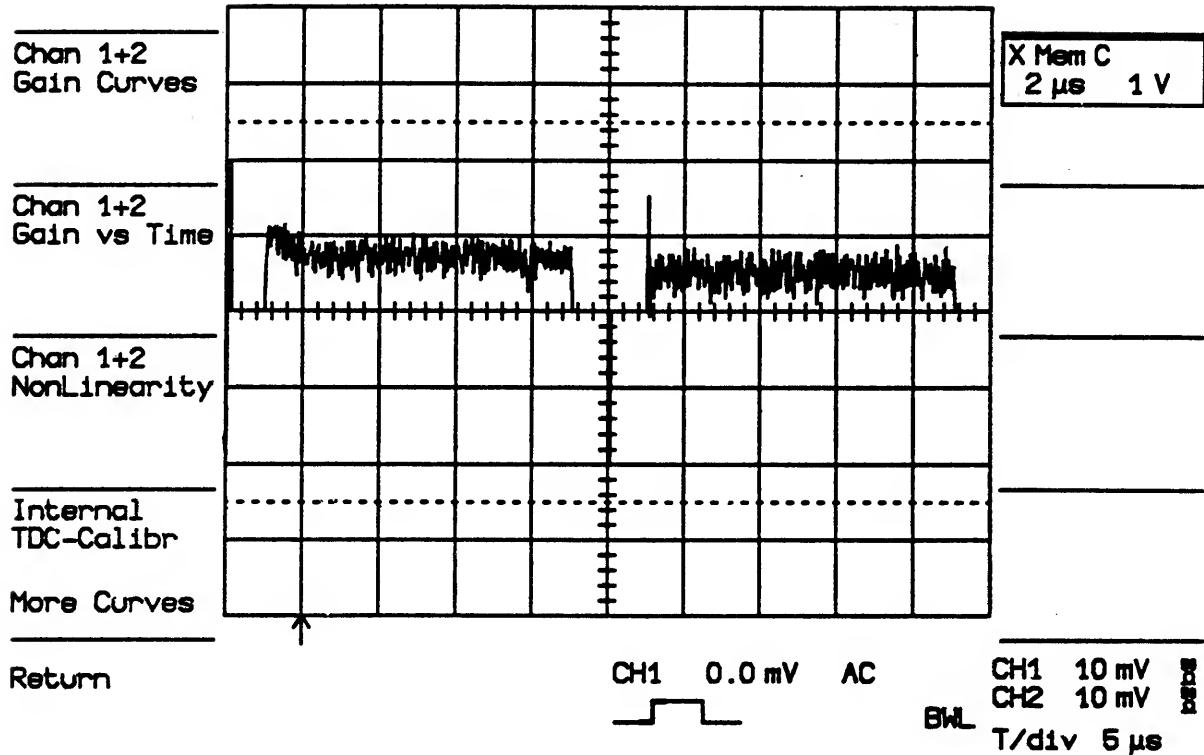


Figure 4: CH 1+2 Gain vs Time

## 8 Bandwidth at 50 $\Omega$ Input Impedance

The purpose of this test is to ensure that the entire 9450 system has a bandwidth of at least 350 MHz at 50  $\Omega$  input impedance.

Set up a Leveled Sine Wave Generator (for example Marconi 2019A):

- Frequency .5 MHz
- Amplitude 2.8 V p-p (maximum for Marconi)

Connect the generator output to CH1 input.

Turn off all the traces except CH1.

Set the trigger:

SMART (COMPLEX) Trigger: OFF  
Source: CH1  
Coupl: HF  
Mode: NORM  
Delay: zero  
Level: zero

Set input CH1:

Coupl: 50  $\Omega$   
Gain: 1V/div  
Var Gain: 1  
Offset: zero

Set the time base:

-Time/div .5  $\mu$ sec/div  
-Interleaved ON

Bandwidth limit: OFF

Adjust the generator output amplitude and CH1 offset to get a 5 division p-p sine wave, or maximum possible from the generator for the large V/div gains (Marconi 2.8 V p-p maximum).

Increase the generator frequency, while decreasing the Time/div until the sine wave p-p amplitude is  $.7 * 5$  divisions = 3.5 divisions (3 dB point), or 70% of the initial amplitude at .5 MHz.

Check:

- the frequency of the generator must be at least 350 MHz

Repeat the above for CH1 and CH2 for input Volts/div = .5 V, .2 V, .1 V, 50 mV, 20mV, 10 mV, 5 mV.

Set the bandwidth limiter ON.

Repeat the same test as for the bandwidth limiter OFF.

Check:

- the frequency of the generator at the 3 dB point must be 70 MHz  $\pm$  20%

## 9 Bandwidth at 1 M $\Omega$ Input Impedance (at Probe Tip)

The purpose of this test is to ensure that the entire 9450 system has a bandwidth of at least 200 MHz at probe tip at 1 M $\Omega$  input impedance.

Set up a Tektronix SG 503 Leveled Sine Wave Generator or equivalent (note for the Marconi that the maximum amplitude is smaller than 5 V):

- Frequency .5 MHz
- Amplitude 5 V p-p

Terminate the output of the SG 503 via a 50  $\Omega$  feedthrough and connect it to the CH1 input through a 300 MHz 10 M $\Omega$  /10 probe using the probe tip - BCN jack. Make sure the probe has a 300 MHz bandwidth (for example our model P9020 M15x10HF), and is perfectly adjusted, low frequency and high frequency (see brochure enclosed with probe).

Turn off all the traces except CH1.

Trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	CH1
Coupl:	HF
Mode:	NORM
Delay:	zero
Level:	zero

Set the input of CH1:

- Coupl:	1 M $\Omega$ AC
- Gain:	.1 V/div
- Var:	Gain 1
- Offset:	zero

Set the time base:

- Time/div	.5 $\mu$ sec/div
- Interleaved	ON

Bandwidth limit OFF

Adjust the SG 503 output amplitude and the CH1 offset to provide a 5 division p-p sine wave.

Increase the SG 503 frequency, while decreasing the Time/div until the sine wave p-p amplitude is  $.7 * 5 \text{ divisions} = 3.5 \text{ divisions}$  (3 dB point).

Check:

- the frequency of the SG 503 must be at least 200 MHz

Repeat the above for CH1 and CH2 for input Volts/div = 50 mV, 20 mV, 10 mV, and 5 mV.

Set the bandwidth limiter ON.

Repeat the same test as for bandwidth limiter OFF.

Check:

- the frequency of the SG 503 at the 3 dB point must be  $75 \text{ MHz} \pm 20\%$

10

#### Trigger Level for DC and HFRej

Set up any sine wave generator, capable of generating sine waves to 500 Hz, for example Intron IFG-422 or Topward TFG-8101:

- frequency 500 Hz

Connect the output of the generator to EXT input and to CH1 via a coaxial T-connector. The cable length from EXT to CH1 must be short, at most 2 nsec.

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	CH1
Coupl:	DC
Mode:	NORM
Delay:	50% Pretrigger
Level	zero

Set the input CH1:

- Coupl:	1 M $\Omega$ , DC
- Gain:	.5 V/div
- Var:	Gain 1
- Offset:	zero

Set the time base:

- Time/div:	.2 msec/div
-------------	-------------

Adjust the sine wave generator's output amplitude to get 8 divisions p-p, corresponding to a 2 V amplitude. It is important that the offset of the input is set to zero (use Panel Status to verify). Use the offset adjustment of the sine wave generator to center the signal with respect to the screen. Later, the test on the EXT trigger level requires that the signal has an absolute range of  $\pm 2$  V.

Check:

- the sine wave must pass through the horizontal center of the screen (50% pretrigger line) at the vertical position zero (vertical center) within  $\pm 3$  minor divisions

Repeat for the following conditions:

- trigger slope POS and NEG (verify slope at check point)
- trigger coupling DC and HFRej

Set the trigger level to + 1.5 V.

Check:

- the sine wave must pass the horizontal center at + 3 divisions within  $\pm 3$  minor divisions

Repeat for the following conditions:

- trigger slope POS and NEG (verify slope at check point)
- trigger coupling DC and HFRej

Set the trigger level to - 1.5 V.

Check:

- the sine wave must pass the horizontal center at - 3 divisions within  $\pm 3$  minor divisions

Repeat for the following conditions:

- trigger slope POS and NEG (verify slope at check point)
- trigger coupling DC and HFRej

Disconnect the input from CH1 and connect it to input of CH2.

Turn off all the traces except for CH2.

Set input CH2:

- Coupl:	1 M $\Omega$ , DC
- Gain:	.5 V/div
- Var:	Gain 1
- Offset:	zero

Set the trigger source to CH2.

Repeat the above check procedure for CH2.

Leave the input connected to CH2, leave the trace of CH2 on.

Set trigger source to EXT.

Repeat the above check procedure for EXT trigger, but observing the effect on CH2. The tolerance for the level crossing is  $\pm 4$  minor divisions for the EXT trigger level.

## 11 Bandwidth for EXT Trigger

Set up a sine wave generator (for example Marconi 2019A):

- Frequency 250 MHz
- Amplitude 2.8 V p-p (maximum for Marconi)

Connect the output of the generator to EXT input and to CH1 using a coaxial T-connector. The cable length between EXT and CH1 must be short (at most 2 nsec).

Set up the DS0:

Turn off all the traces except CH1.

Set the trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	EXT
Coupl:	DC
Mode:	NORM
Delay	50%
Level	zero



Set input CH1:

- Coupl	50 $\Omega$
- Gain	.5 V/div
- Var	Gain 1
- Offset	zero

Set the time base:

- Time/div	5 nsec/div
- Interleaved	ON

Check:

- The scope must keep triggering in a stable way (i.e., a smooth 250 MHz sine wave must be visible on the display).

## 12 Smart/Complex Trigger

### 12.1 Trigger on Pulse Width >, <

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

Smart/Complex Trigger:	ON
Trigger Type:	SINGLE SOURCE
Width Type:	PULSE WIDTH
Source:	CH1
Coupl:	AC
Slope:	+
Level:	zero
Delay:	20% Pretrigger

Set the input of CH1:

- Coupl:	50 $\Omega$
- Gain:	.5 V/div
- Var:	Gain 1
- Offset:	zero

Set the time base:

- Time/div:	20 nsec/div
- Interleaved:	ON

Apply sine wave signal 3 V p-p of 75 MHz. Adjust PULSE Width to 7.5 nsec for both < and >, and switch between WIDTH < and WIDTH >.

Check:

- Width < 7.5 nsec                      scope should trigger
- Width > 7.5 nsec                      scope should NOT trigger

Set the sine wave generator to 230 MHz. Adjust PULSE WIDTH to 2.5 nsec and switch between WIDTH < and WIDTH >.

Check:

- Width < 2.5 nsec                      scope should trigger
- Width > 2.5 nsec                      scope should NOT trigger

Repeat the above test for CH2.

## 12.2 Trigger on Interval Width <

Set up the DS0:

Turn off all the traces except CH1.

Set the trigger:

- Smart/Complex Trigger                  ON
- Trigger Type                            SINGLE SOURCE
- Width Type                              INTERVAL WIDTH
- Source                                   CH1
- Coupl                                   AC
- Slope                                   +
- Level                                   zero
- Delay                                   20% Pretrigger

Set the input of CH1:

- Coupl                                   50  $\Omega$
- Gain                                   .5 V/div
- Var                                   Gain 1
- Offset                                   zero

Set the time base:

- Time/div 2 nsec/div
- Interleaved ON

Apply a sine wave signal 3 V p-p of 200 MHz to CH1. Turn to INTERVAL Width < and adjust width to 10 nsec.

Check:

- 200 MHz: Width < 10 nsec, scope should trigger
- 110 MHz: Width < 10 nsec, scope should trigger
- 91 MHz: Width < 10 nsec, scope should NOT trigger

Set frequency to 7 MHz and INTERVAL Width to < 15 nsec.

Check:

- 74 MHz: Width < 15 nsec, scope should trigger
- 61 MHz: Width < 15 nsec, scope should NOT trigger

### 12.3 Trigger on Interval Width >

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

- Smart/Complex Trigger ON
- Trigger Type SINGLE SOURCE
- Width Type INTERVAL WIDTH
- Source CH1
- Coupl AC
- Slope +
- Level zero
- Delay 20% Pretrigger

Set the input of CH1:

- Coupl 50  $\Omega$
- Gain .5 V/div
- Var Gain 1
- Offset zero

Set the time base:

- Time/div 5 nsec/div
- Interleaved ON

Apply sine wave signal 3 V p-p of 100 MHz to CH1. Turn to INTERVAL Width > and adjust width to 25 nsec.

Check:

- 100 MHz: Width > 25 nsec, scope should NOT trigger
- 44 MHz: Width > 25 nsec, scope should NOT trigger
- 37 MHz: Width > 25 nsec, scope should trigger

Set the frequency to 40 MHz and INTERVAL Width to > 27.5 nsec.

Check:

- 40 MHz: Width > 27.5 nsec, scope should NOT trigger
- 33 MHz: Width > 27.5 nsec, scope should trigger

Repeat the above test for CH2.

### 13 Time Base Accuracy

In order to verify the time base, use a sine wave generator of 1 MHz with a frequency accuracy of better than 10 ppm (for example Marconi 2019A).

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

- SMART (COMPLEX) Trigger OFF
- Source CH1
- Coupl DC
- Mode NORM
- Slope +
- Delay 0%
- Level zero

Set the input of CH1:

- Coupl 50  $\Omega$   
- Gain .5 V/div  
- Var Gain 1  
- Offset zero

Set the time base:

- Time/div 2  $\mu\text{sec/div}$   
- Interleaved ON

Set the sine wave generator to 1 MHz and put a signal on to CH1. Adjust amplitude to get about a 6 division p-p signal.

Select trigger mode SINGLE (HOLD).

Turn DUAL GRID ON.

Turn ON EXPAND A with CH1 as the source.

Adjust TIME MAGNIFIER to .1  $\mu\text{sec/div}$ .

Turn horizontal POSITION on DISPLAY CONTROL to select the 3rd period of the displayed waveform.

Put the expanded trace on the second grid using the vertical POSITION knob, see Figure 5.

21-Apr-89  
10:12:18

LeCroy

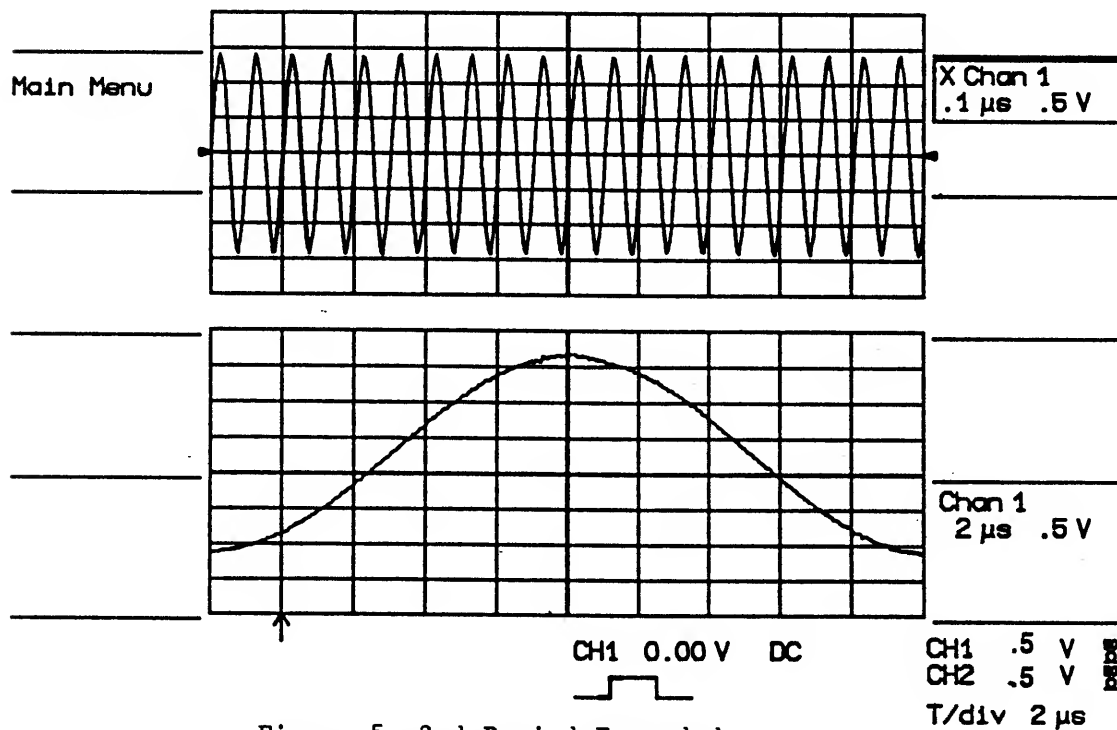


Figure 5: 3rd Period Expanded

Turn ON EXPAND B with CH1 as the source.

Adjust TIME MAGNIFIER to .1  $\mu\text{sec}/\text{div}$ .

Turn the horizontal POSITION on DISPLAY CONTROL to select the 13th period.

Overlay the 2 expanded traces on the lower grid using vertical and horizontal POSITION knobs on DISPLAY CONTROL, see Figure 6.

26-Apr-89  
16:28:42

LeCroy

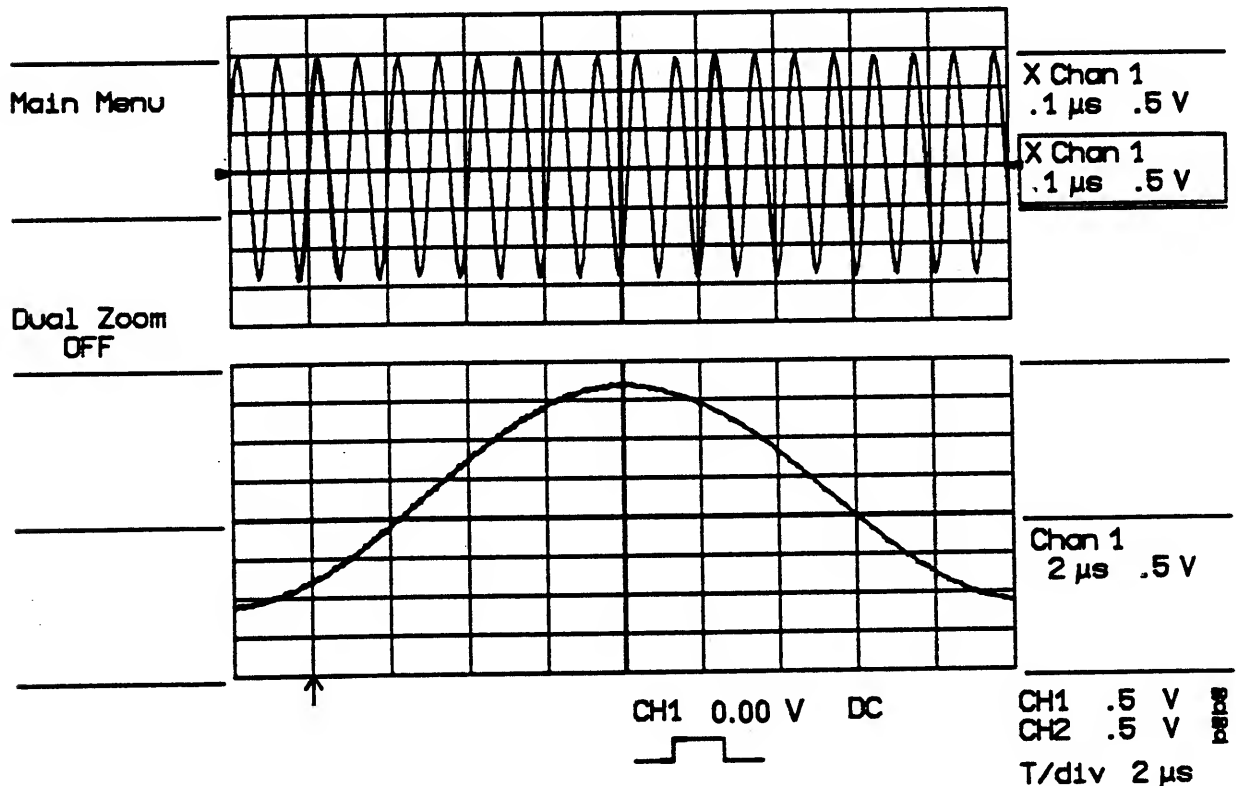


Figure 6: 3rd and 13th period overlaid

Measurement of the time difference:

- turn the RELATIVE TIME CURSORS ON
- put the REFERENCE cursor on top of the 3rd period (check on upper grid)
- Put the DIFFERENCE cursor on top of the 13th period (check on upper grid) and adjust alignment of the two cursors (check on lower grid), see Figure 7.

25-Apr-89  
17:01:35

LeCroy

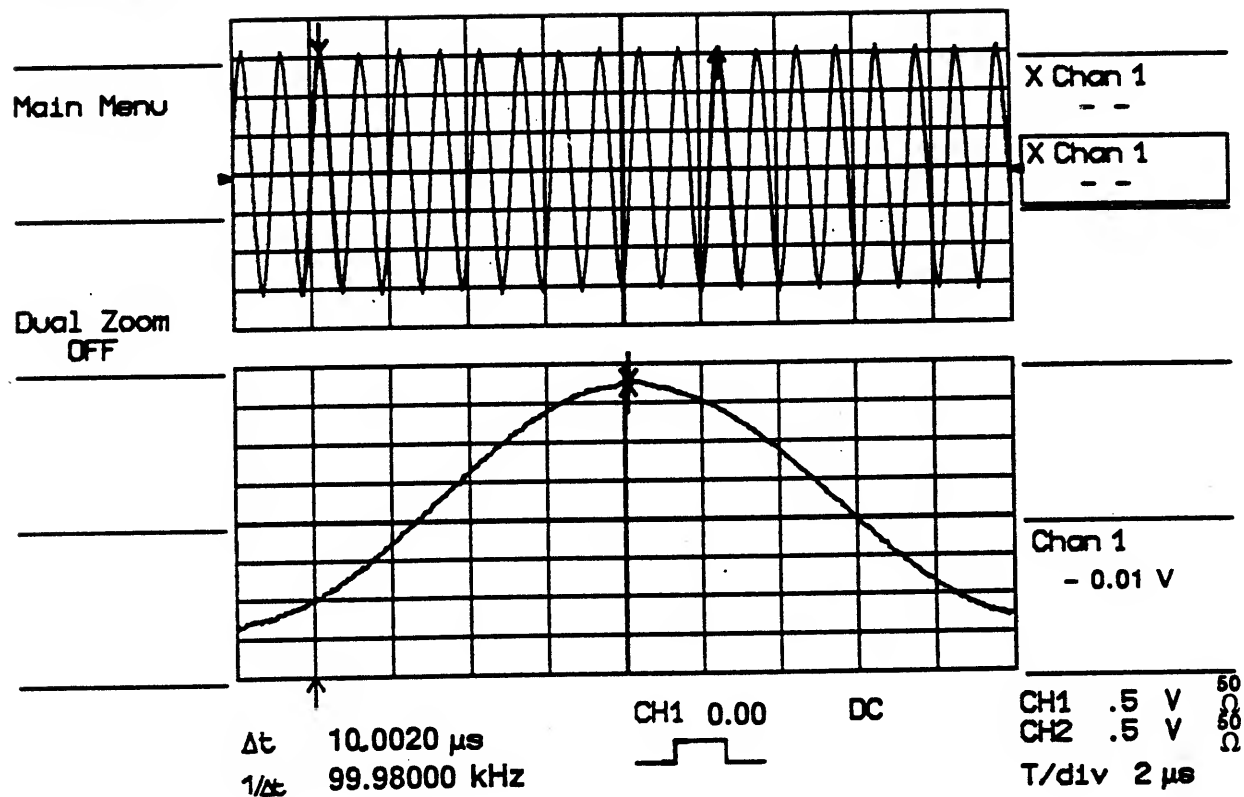


Figure 7: Aligned cursors

Turn DUAL ZOOM ON.

Turn TIME MAGNIFIER (DISPLAY CONTROL) to select the maximum expansion.  
Refine adjustment of the two cursors, see Figure 8.

26-Apr-89  
9:52:13

LeCroy

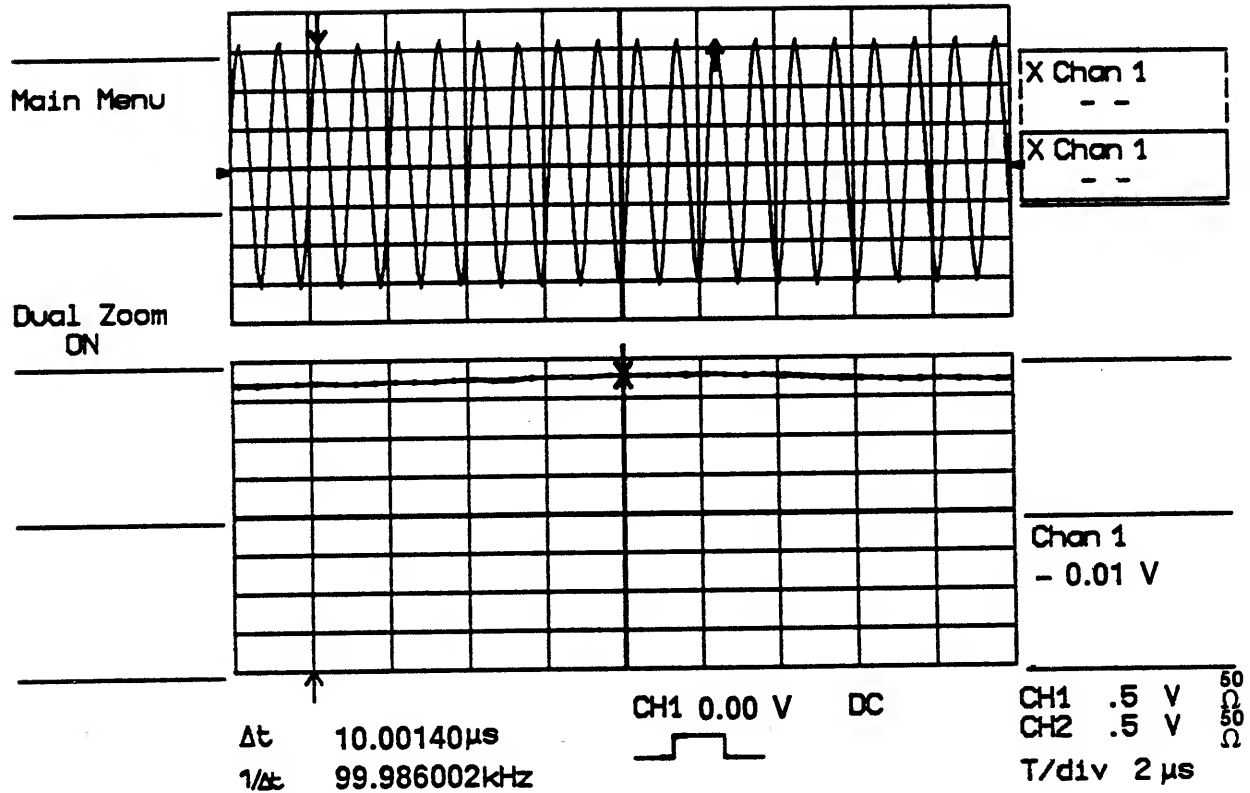


Figure 8: Alignment of cursors with maximum expansion.

Check:

- The difference time reading must be within 9.998 and 10.002  $\mu sec$

RH/10.11.89



**SERVICE INFORMATION**

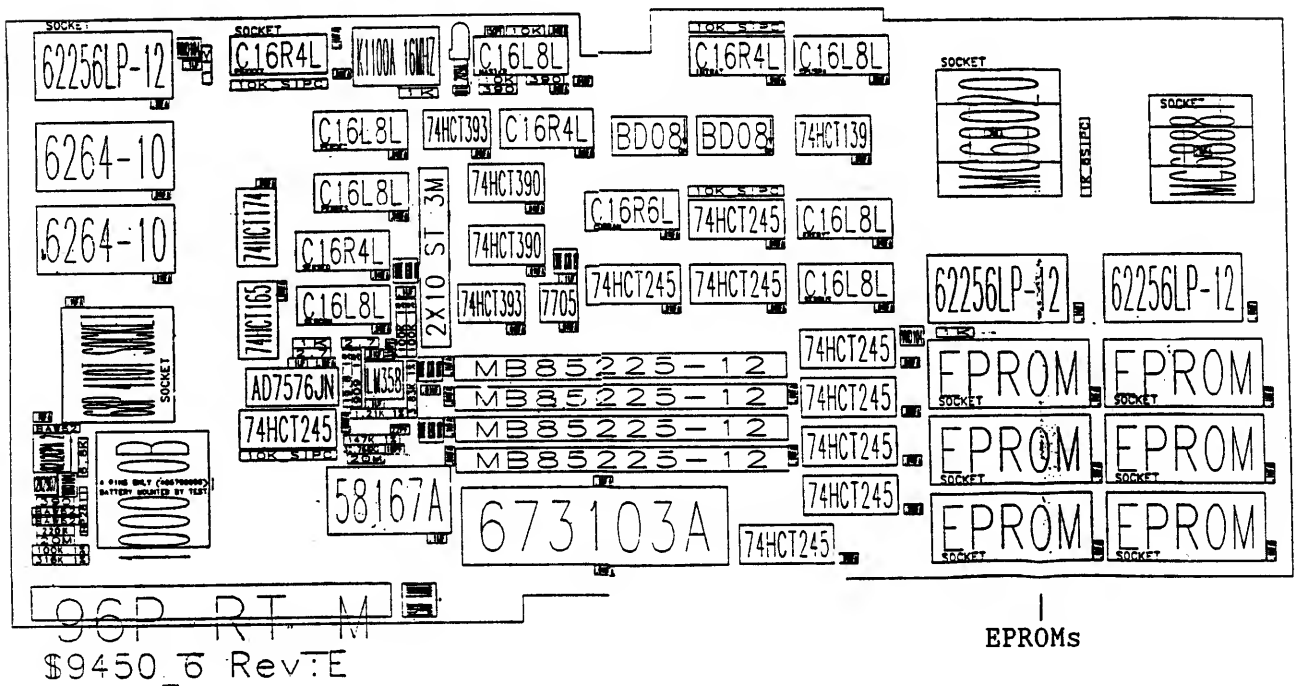
**AND**

**PROCEDURES**

# **SOFTWARE UPGRADE PROCEDURE** or 9420-6

1. Remove the 9450-6 processor board from the oscilloscope.
2. Replace EPROMs at location A1 to A6 with the latest version. Make sure that the guiding notch in the chip is aligned with the PCB.
3. Insert the Software Option Selection PAL into location A45. Make sure that the guiding notch is correctly aligned.
4. Reassemble scope and check that it boots up properly.

## **Selection PAL**



The following two adjustments have to be made after the front-end 9450-7 has been mounted into the scope:

### 1. 9420 50 Ohm Overload Protection Adjustment Procedure

Two different thermocouples exist; an old type wrapped in a heat shrink tube and a new type wrapped in copper wire. The adjustment procedures are the same for old and new thermocouple, but they depend on the Revision of the 9450-7 front-end board:

#### **Procedure for 9450-7 up to Rev D:**

- The front-end has to be in the DSO with the RF shields (aluminum covers) mounted and the upper DSO cover closed. Warm the scope up for 20 minutes.
- Make sure the 9450-7 front-end board is at ECO 1003, MCN 1 or up.
- Apply 5.5 V to CH1 set to 50 Ohm. Wait for 30 sec. Adjust CH1 overload detection (potentiometer through opening in 9450-7 aluminum cover) such that pin 10 of A21 is about 200 mV below threshold on pin 11 of A21 (about 1.6 V).
- Apply 7.0 V to CH1. Adjust potentiometer such that the overload trips within 5 to 20 seconds. Between each test, allow the thermocouple to cool to ambient temperature. Make sure it does not come on by itself after power on. It should not come on with a voltage of 5.0 V applied to the input.
- The same for CH2, where the adjustment is made at pin 8 of A21 for the threshold at pin 9 of A21.

#### **Procedure for 9450-7 at Rev F and up:**

- The front-end has to be in the DSO with the RF shields (aluminum covers) mounted and the upper DSO cover closed. Warm the scope for 20 minutes.
- Put jumpers on pins 1 and 2 of J12 (CH1) and 1 and 2 of J10 (CH2). This disables triggering of the overload system. Pins 1 and 3 off J12 are on the side facing the potentiometers:

J10	pin2	pin4	pin2	pin4	J12
	pin1	pin3	pin1	pin3	

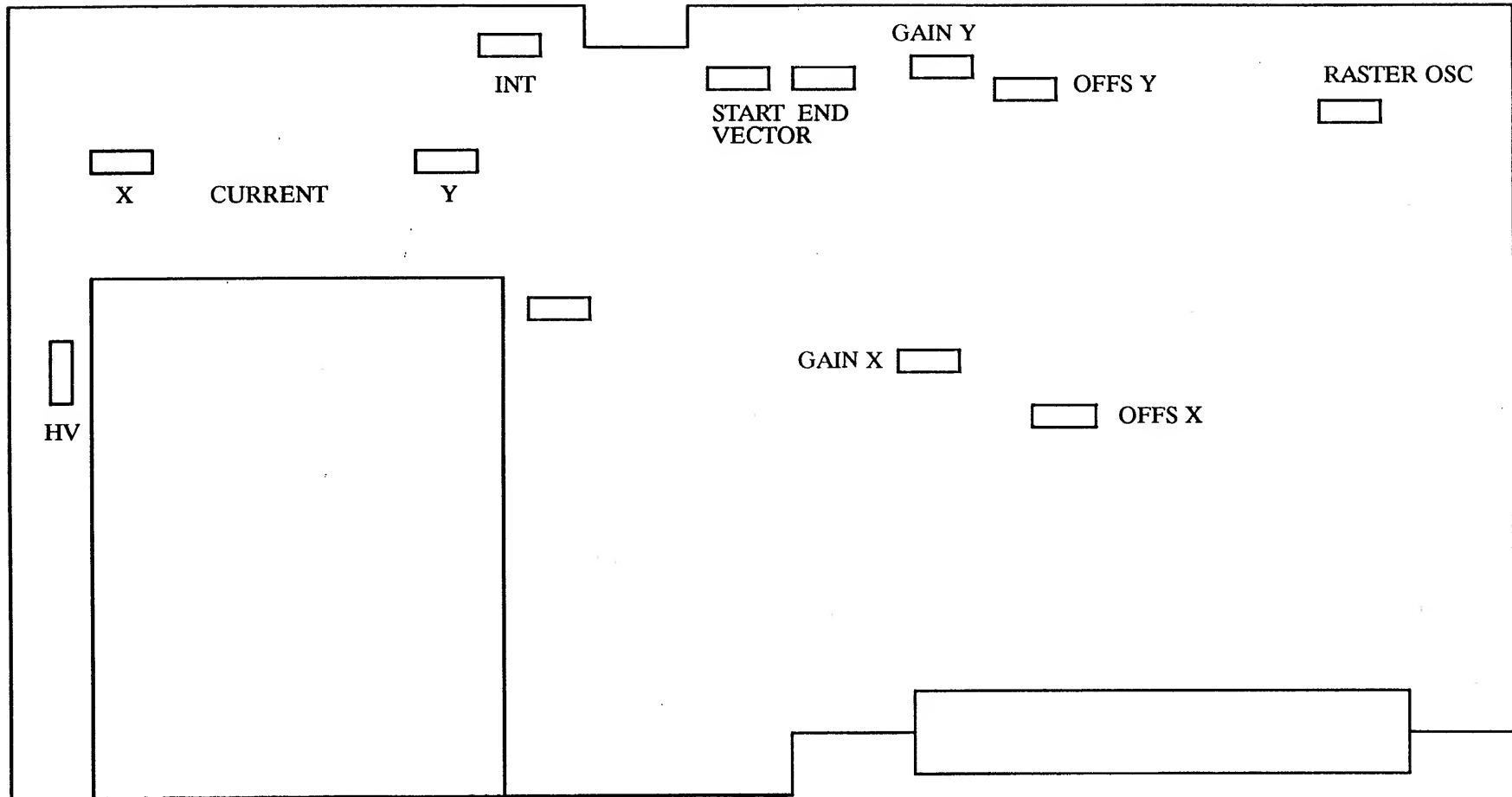
R15  
R16

- Select 0.1 V/div, 50 Ohm, 1 sec/div for the channel to be adjusted.
- Probe on pins 3 of J10 and J12.
- Apply 6.0 V on the input and wait for 30 sec. Adjust potentiometer R15 (CH1) or R16 (CH2) such that you get on pins 3 of J12 (CH1) or J10 (CH2) 0 V within 40 mV.
- Remove the jumpers. Check that for an applied voltage of 5.2 v the system does not trigger. It should switch to overload within less than 10 seconds for 7.0 V. Between each test, allow the thermocouple to cool to ambient temperature.

## 2. 9450 EXT Trigger Level and Compensation

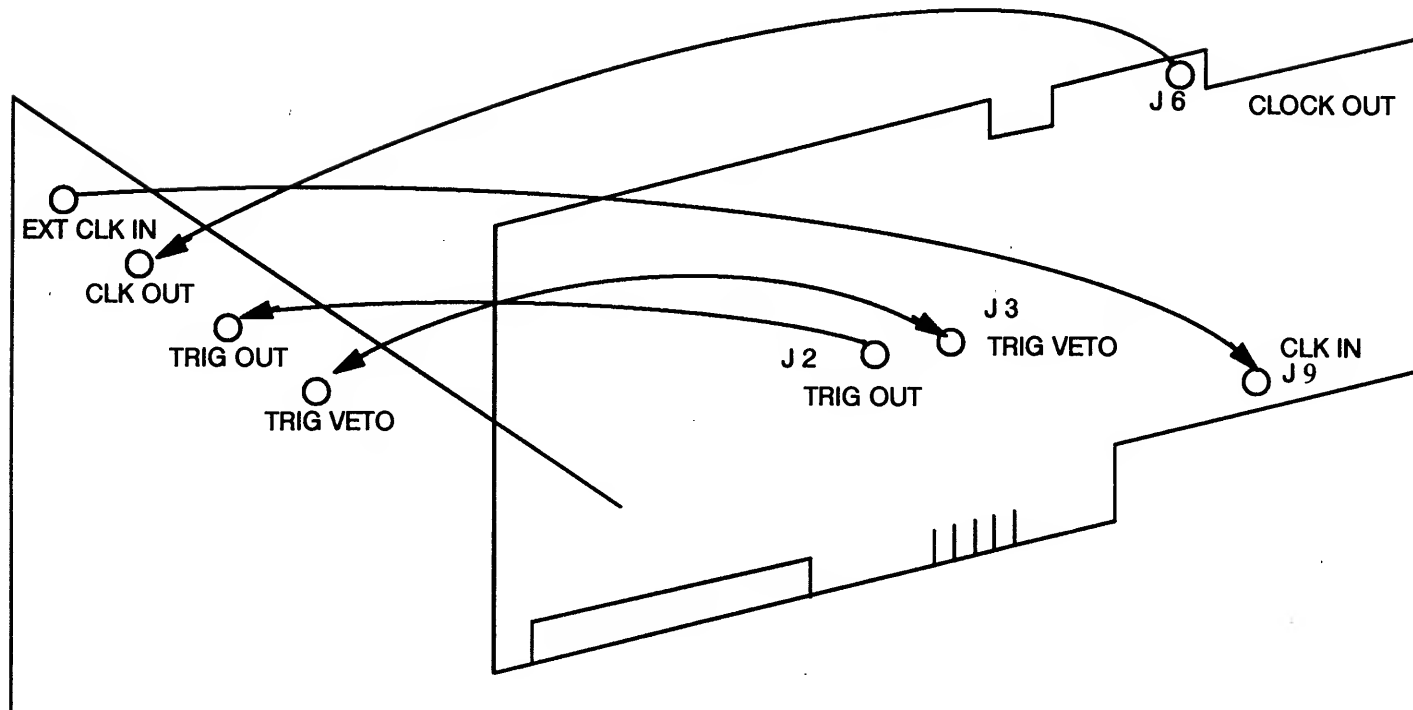
- 1) Set scope to CH1 50 Ohm, 20 mV/div, offset zero, 10 usec/div, BWL OFF.  
Normal Trigger EXT DC NORM, offset zero, delay 50%.
- 2) Apply 1 kHz sine wave 120 mV peak-to-peak with zero offset to CH1 through EXT.
- 3) Adjust EXT trigger level with potentiometer R29 on 9450-7 in order to center the POS and NEG slope signal crossing at trigger point around zero.
- 4) Set time base to 0.1 usc/div.  
Recheck trigger levels according to points 2) and 3) with a 1 MHz sine wave.  
If not OK at 1 MHz, adjust the EXT HHZ406 as follows, using the 9450-7 Extension Cable Set:
  - a. Set time base to 10 usec/div. Set TRIG to EXT. Apply a 10 KHz 3 V peak-to-peak square wave from a TFG-8101/FG-422 or equivalent signal generator to EXT. Probe HHZ406 output at pin 6 with an adjusted probe and adjust the 3 capacitors on the HHZ406 to get a flat square wave without under/overshoot.
  - b. Set scope to EXT/10. Apply a 20 v peak-to-peak square wave to EXT and probe at pin 6 of the TRIG HHZ406 output. Adjust the 3 capacitors to get a flat square wave without over/undershoot. Go back to point a. and check again.

TOP



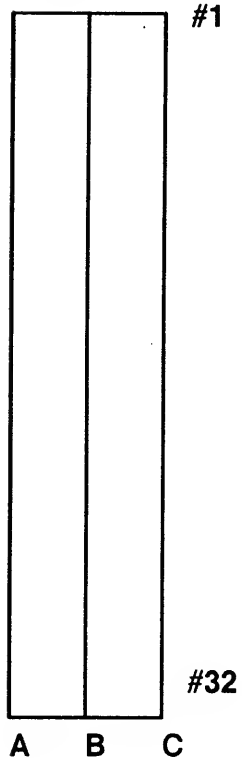
9450 - 2 POT LAYOUT

## 9450-4 CABLING DIAGRAM

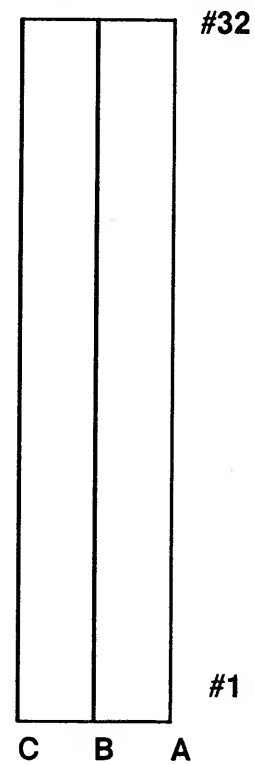


BOARD CONNECTOR PIN-OUT

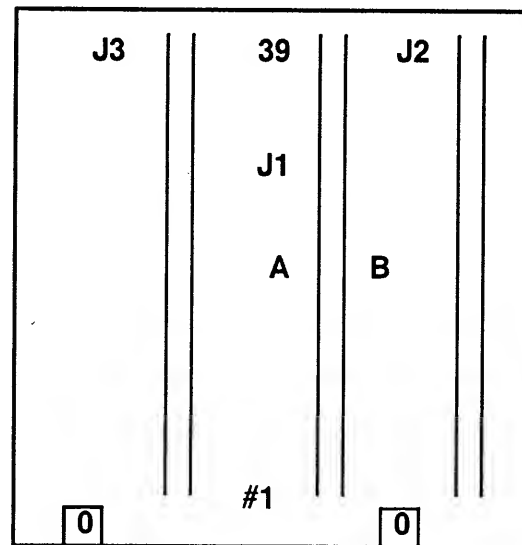
DISPLAY



PROCESSOR, ADC, TDC



CLK BUS

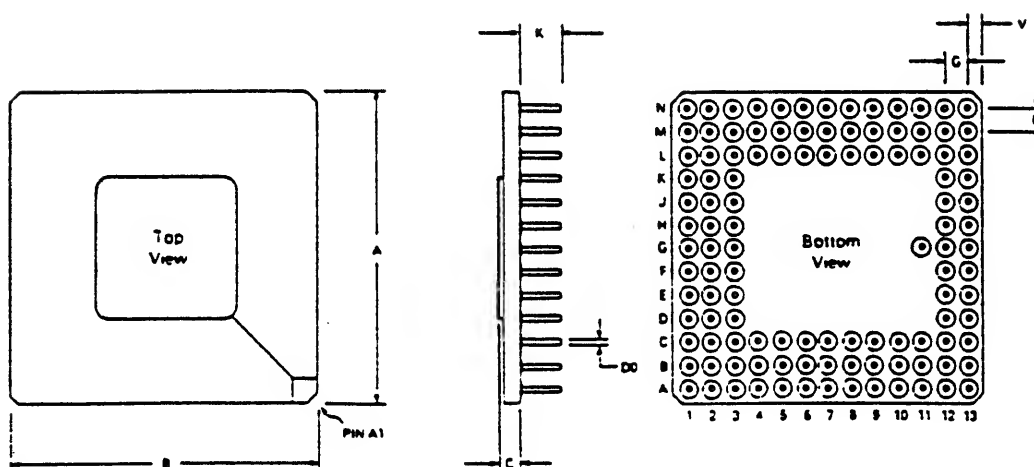


SEEN  
FROM  
TOP - FRONT

## 11.2 PACKAGE DIMENSIONS AND PIN ASSIGNMENT

MC68020  
RC Suffix Package  
Preliminary  
Mechanical  
Detail

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	34.18	34.90	1.345	1.375
B	34.18	34.90	1.345	1.375
C	2.67	3.17	.100	.150
D0	.46	.51	.017	.019
E	2.54 BSC		.100 BSC	
K	4.32	4.82	.170	.190
V	1.74	2.28	.065	.095





Pin Number	Function	Pin Number	Function	Pin Number	Function
A1	$\overline{BGACK}$	D1	VCC	K1	GND
A2	A1	D2	VCC	K2	$\overline{HALT}$
A3	A31	D3	VCC	K3	GND
A4	A28	D4-D11	-	K12	D1
A5	A26	D12	A4	K13	D0
A6	A23	D13	A3		
A7	A22			L1	$\overline{AS}$
A8	A19			L2	$\overline{R/W}$
A9	VCC	E1	$\overline{FC0}$	L3	D30
A10	GND	E2	$\overline{RMC}$	L4	D27
A11	A14	E3	VCC	L5	D23
A12	A11	E12	A2	L6	D19
A13	A8	E13	$\overline{OCS}$	L7	GND
				L8	D15
				L9	D11
				L10	D7
B1	GND	F1	SIZ0	L11	GND
B2	$\overline{BG}$	F2	$\overline{FC2}$	L12	D3
B3	$\overline{BR}$	F3	$\overline{FC1}$	L13	D2
B4	A30	F12	GND		
B5	A27	F13	$\overline{IPEND}$	M1	$\overline{DS}$
B6	A24			M2	D29
B7	A20			M3	D26
B8	A18			M4	D24
B9	GND	G1	$\overline{ECS}$	M5	D21
B10	A15	G2	SIZ1	M6	D18
B11	A13	G3	$\overline{DBEN}$	M7	D16
B12	A10	G11	VCC	M8	VCC
B13	A6	G12	GND	M9	D13
		G13	VCC	M10	D10
				M11	D6
				M12	D5
				M13	D4
C1	$\overline{RESET}$			N1	D31
C2	CLOCK	H1	$\overline{COIS}$	N2	D28
C3	GND	H2	$\overline{AVEC}$	N3	D25
C4	A0	H3	$\overline{DSACK0}$	N4	D22
C5	A29	H12	$\overline{IPL2}$	N5	D20
C6	A25	H13	GND	N6	D17
C7	A21			N7	GND
C8	A17			N8	VCC
C9	A16	J1	$\overline{DSACK1}$	N9	D14
C10	A12	J2	$\overline{BERR}$	N10	D12
C11	A9	J3	GND	N11	D9
C12	A7	J12	$\overline{IPL0}$	N12	D8
C13	A5	J13	$\overline{IPL1}$	N13	VCC

The VCC and GND pins are separated into three groups to provide individual power supply connections for the address bus buffers, data bus buffers, and all other output buffers and internal logic.

Group	VCC	GND
Address Bus	A9, D3	A10, B9, C3, F12
Data Bus	M8, N8, N13	L7, L11, N7, K3
Logic	D1, D2, E3, G11, G13	G12, H13, J3, K1
Clock		B1

## SECTION 11 ORDERING INFORMATION AND MECHANICAL DATA

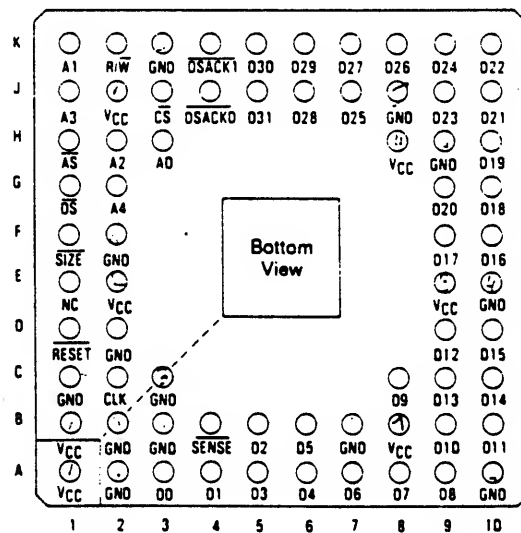
This section contains the pin assignments and package dimensions of the MC68881. In addition, detailed information is provided to be used as a guide when ordering.

### 11.1 STANDARD MC68881 ORDERING INFORMATION

Package Type	Frequency (MHz)	Temperature	Order Number
Pin Grid Array	12.5	0°C to 70°C	MC68881RC12
RC Suffix	16.67	0°C to 70°C	MC68881RC16

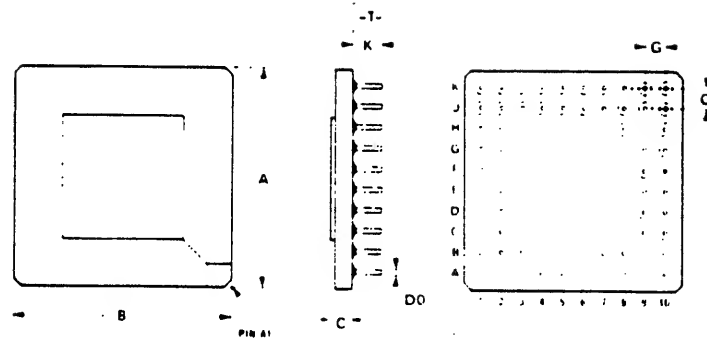
### 11.2 PIN ASSIGNMENTS

68-PIN GRID ARRAY



### 11.3 PACKAGE DIMENSIONS

RC SUFFIX  
PIN GRID ARRAY  
CASE 765A-03



- NOTES
1. DIMENSIONS A AND B ARE DATUMS AND THE DATUM SURFACE.
  2. POSITIONAL TOLERANCE FOR LEADS 68 PLACES 0.010 (0.004) IN (0.152) IN (0.004) IN (0.152) IN.
  3. DIMENSION N AND TOLERANCE PER ANSI Y14.5M 1982.
  4. CONTROLLING DIMENSION INCH.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	26.67	27.14	1.051	1.071
B	26.67	27.14	1.051	1.071
C	1.51	2.60	0.059	0.102
D	1.41	1.60	0.055	0.063
E	1.41	1.60	0.055	0.063
F	1.41	1.60	0.055	0.063
G	1.41	1.60	0.055	0.063
H	1.41	1.60	0.055	0.063

# TMS32020 DIGITAL SIGNAL PROCESSOR

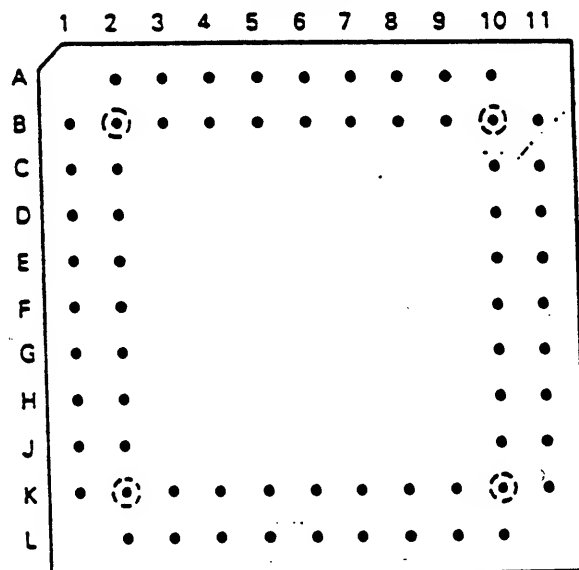
MARCH 1985—REVISED MAY 1986

- 200-ns Instruction Cycle Time
- 544 Words of Programmable On-Chip Data RAM
- 128K Words of Data/Program Space
- Sixteen Input and Sixteen Output Channels
- 16-Bit Parallel Interface
- Directly Accessible External Data Memory Space
- Global Data Memory Interface
- 16-Bit Instruction and Data Words
- 32-Bit ALU and Accumulator
- Single-Cycle Multiply/Accumulate Instructions
- 0 to 16-Bit Scaling Shifter
- Bit Manipulation and Logical Instructions
- Instruction Set Support for Floating-Point Operations
- Block Moves for Data/Program Management
- Repeat Instructions for Efficient Use of Program Space
- Five Auxiliary Registers and Dedicated Arithmetic Unit for Indirect Addressing
- Serial Port for Direct Codec Interface
- Synchronization Input for Synchronous Multiprocessor Configurations
- Wait States for Communication to Slow Off-Chip Memories/Peripherals
- On-Chip Timer for Control Operations
- Three External Maskable User Interrupts
- Input Pin Polled by Software Branch Instruction
- Programmable Output Pin for Signalling External Devices
- 2.4-Micron NMOS Technology
- Single 5-V Supply
- On-Chip Clock Generator

## PIN ASSIGNMENTS

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
A2	D8	C11	CLKOUT1	J10	$\overline{PS}$
A3	D10	D1	D4	J11	$\overline{IS}$
A4	D12	D2	D3	K1	A0
A5	D14	D10	CLKOUT2	K2	A1
A6	VCC	D11	XF	K3	A3
A7	$\overline{HOLD}$	E1	D2	K4	A5
A8	$\overline{RS}$	E2	D1	K5	A7
A9	CLKX	E10	$\overline{HOLDA}$	K6	A8
A10	VCC	E11	DX	K7	A10
B1	VSS	F1	D0	K8	A12
B2	D7	F2	$\overline{SYNC}$	K9	A14
B3	D9	F10	FSX	K10	$\overline{DS}$
B4	D11	F11	X2/CLKIN	K11	VSS
B5	D13	G1	$\overline{INT0}$	L2	VSS
B6	D15	G2	$\overline{INT1}$	L3	A2
B7	$\overline{BIO}$	G10	X1	L4	A4
B8	READY	G11	$\overline{BR}$	L5	A6
B9	CLKR	H1	$\overline{INT2}$	L6	VCC
B10	VCC	H2	VCC	L7	A9
B11	$\overline{IACK}$	H10	$\overline{STRB}$	L8	A11
C1	D6	H11	R/W	L9	A13
C2	D5	J1	DR	L10	A15
C10	$\overline{MSC}$	J2	FSR		

68-PIN GB  
PIN GRID ARRAY CERAMIC PACKAGE†  
(TOP VIEW)

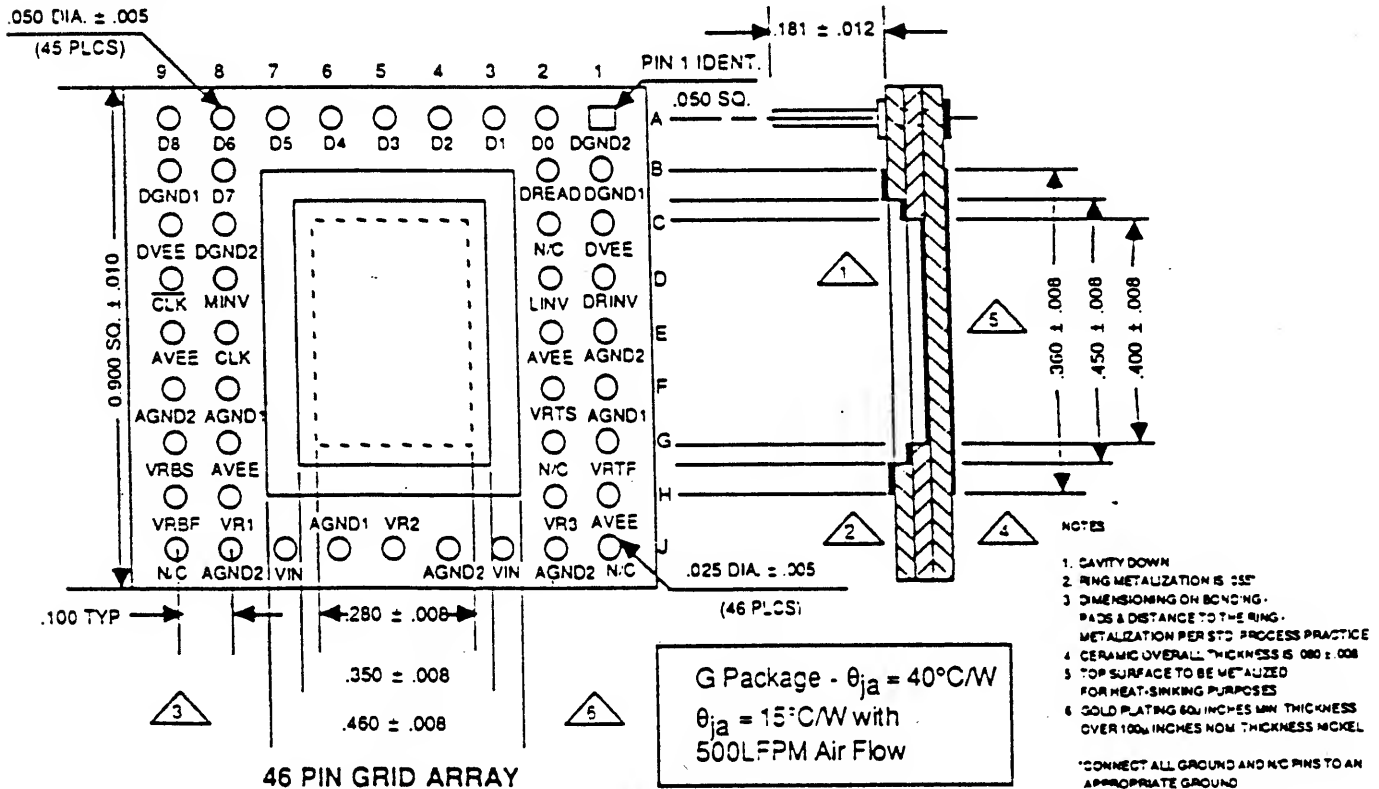


† See Pin Assignments Table (Page 1) and Pin Nomenclature Table (Page 2) for location and description of all pins.

# PIN ASSIGNMENT HADC77200

TOP VIEW				NAME	FUNCTION	NAME	FUNCTION
1	N/C	AVEE	48	DRINV	Data Ready Inverse	CLK	Inverse ECL Clock Input Pin
2	N/C	AGND2	47	LINV	D0 through D6 Output Inversion Control Pin	CLK	ECL Clock Input Pin
3	DRINV	AGND1	46			VRBS	Reference Voltage Bottom, Sense Nominally -2.0V
4	LINV	VRTS	45	AVEE	Negative Analog Supply Nominally -5.2V	VRBF	Reference Voltage Bottom, Force Nominally -2.0V
5	DVEE	VRTF	44			VR1	Reference Voltage Tap 1
6	DGND1	AVEE	43	DVEE	Digital Analog Supply Nominally -5.2V	AGND1	Analog Ground 1
7	DGND2	AVEE	42			VIN	Analog Input, can be connected to the input signal or used as a Sense
8	DREAD	VR3	41	DGND1	Digital Ground 1	AGND2	Analog Ground 2
9	D0 (LSB)	AGND2	40	DGND2	Digital Ground 2	VR2	Reference Voltage Tap 2
10	D1	VIN	39	DREAD	Data Ready Output	VIN	Analog Input, can be connected to the input signal or used as a Sense
11	D2	AGND1	38	DO	Digital Data Output Pin 1 (LSB)	VR3	Reference Voltage Tap 3
12	D3	VR2	37			VRTS	Reference Voltage Top, Sense Nominally 0V
13	D4	AGND1	36	D1..D6	Digital Data Output Pin 2 Through 6	VRTF	Reference Voltage Top, Force Nominally 0V
14	D5	VIN	35	D7	Digital Data Output Pin 7 (MSB)		
15	D6	AGND2	34	D8	Overrange Output		
16	D7 (MSB)	VR1	33				
17	D8 (OVERRANGE)	AVEE	32				
18	DGND2	AVEE	31				
19	DGND1	N/C	30				
20	DVEE	VRBF	29				
21	MINV	VRBS	28				
22	CLK	AGND1	27				
23	CLK	AGND2	26				
24	N/C	AVEE	25				

48 LEAD CERAMIC  
SIDEBRAZED DIP

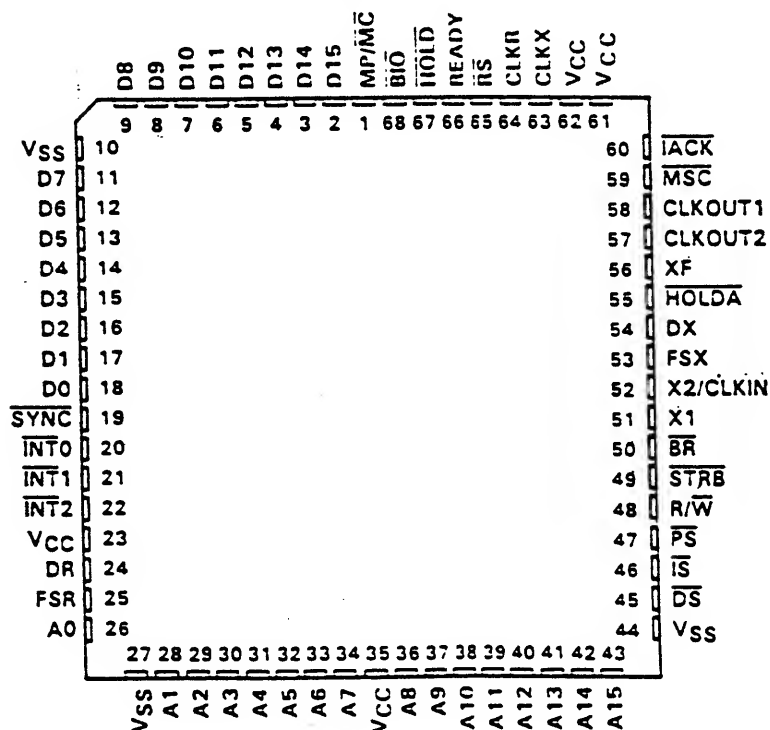


G Package -  $\theta_{ja} = 40^{\circ}\text{C/W}$   
 $\theta_{ja} = 15^{\circ}\text{C/W}$  with  
 500LFPM Air Flow

MAY 1986

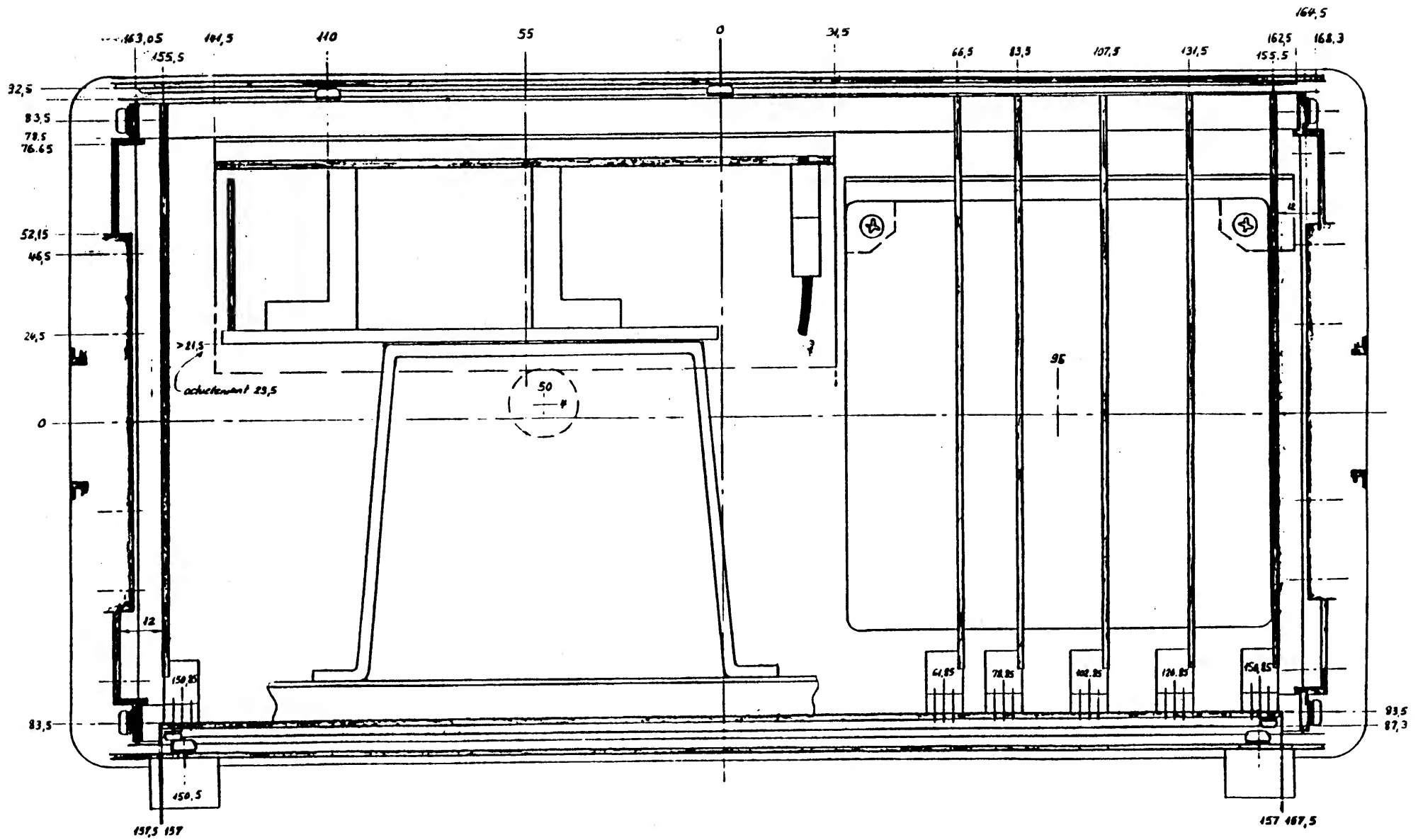
- 100-ns Instruction Cycle Time
- 544 Words of Programmable On-Chip Data RAM
- 4K Words of On-Chip Program ROM
- 128K Words of Data/Program Space
- Sixteen Input and Sixteen Output Channels
- 16-Bit Parallel Interface
- Directly Accessible External Data Memory Space
- Global Data Memory Interface
- 16-Bit Instruction and Data Words
- 32-Bit ALU and Accumulator
- Single-Cycle Multiply/Accumulate Instructions
- 0 to 16-Bit Scaling Shifter
- Bit Manipulation and Logical Instructions
- Instruction Set Support for Floating-Point Operations, Adaptive Filtering, and Extended-Precision Arithmetic
- Block Moves for Data/Program Management
- Repeat Instructions for Efficient Use of Program Space
- Eight Auxiliary Registers and Dedicated Arithmetic Unit for Indirect Addressing
- Serial Port for Direct Codec Interface
- Synchronization Input for Synchronous Multiprocessor Configurations
- Wait States for Communication to Slow Off-Chip Memories/Peripherals
- On-Chip Timer for Control Operations
- Three External Maskable User Interrupts
- Input Pin Polled by Software Branch Instruction
- Programmable Output Pin for Signalling External Devices
- 1.8- $\mu$ m CMOS Technology
- Single 5-V Supply
- On-Chip Clock Generator

68-PIN FN  
PLASTIC LEADED CHIP CARRIER PACKAGE  
(TOP VIEW)

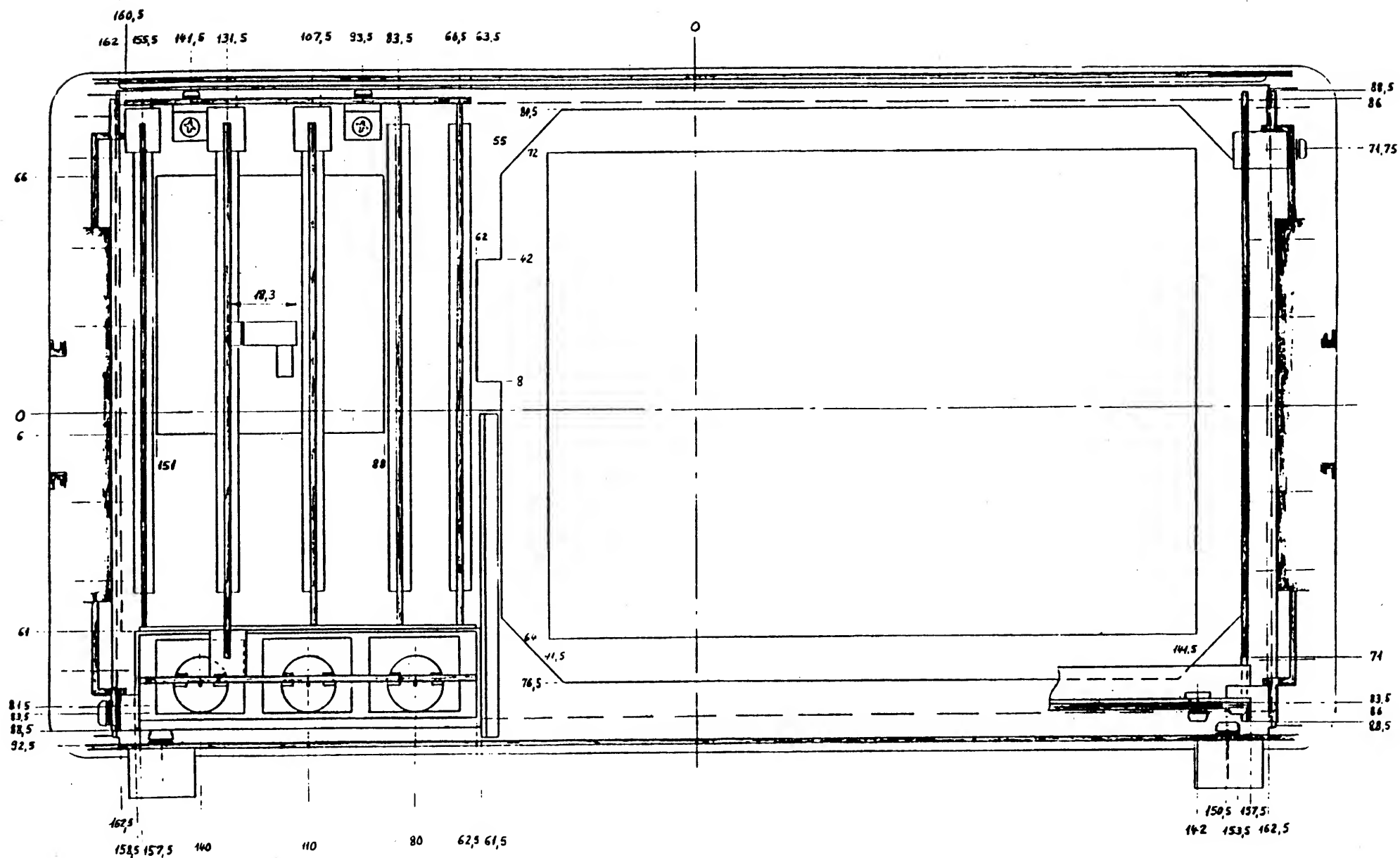


## **Section 5**

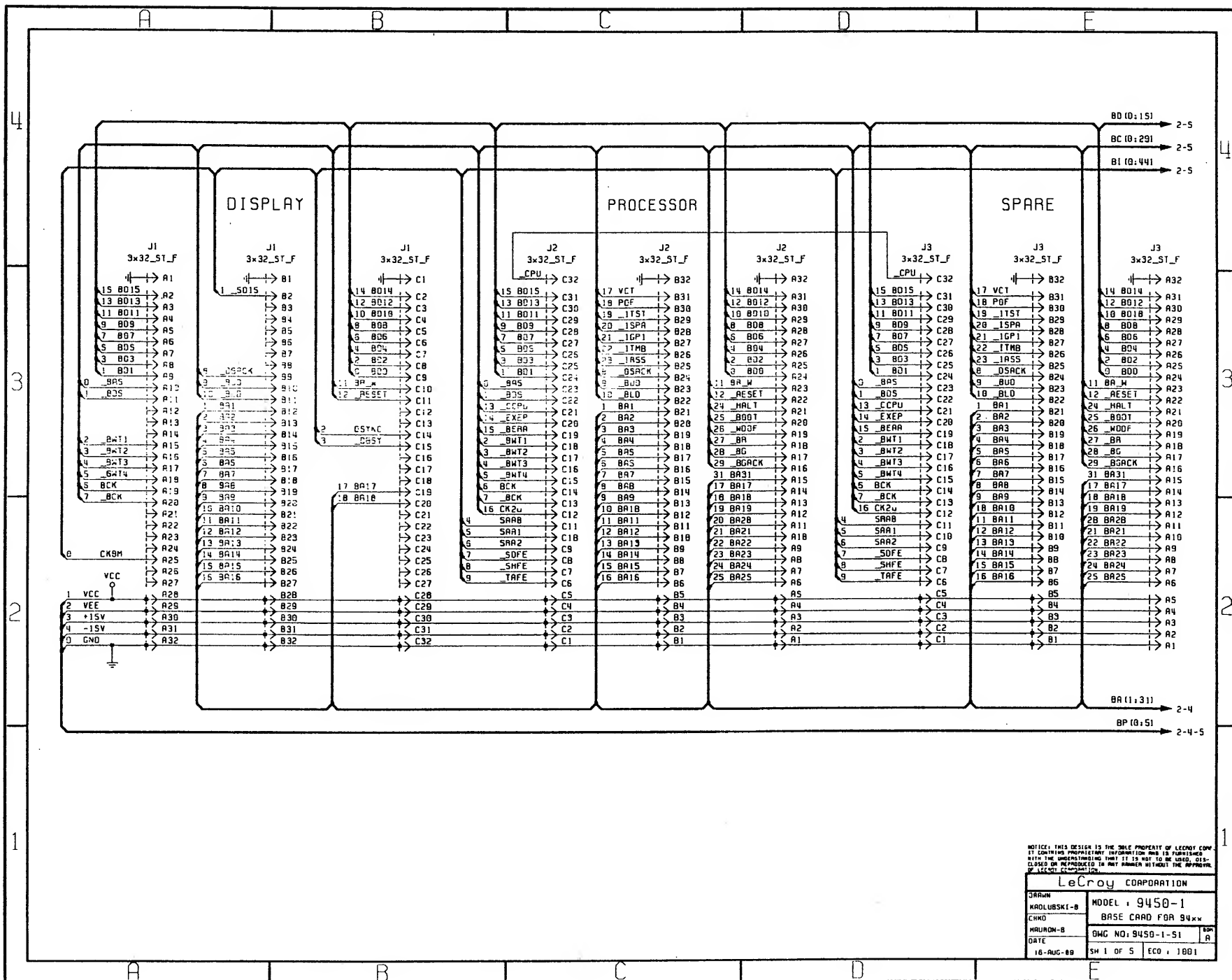
### **MECHANICAL DRAWINGS**

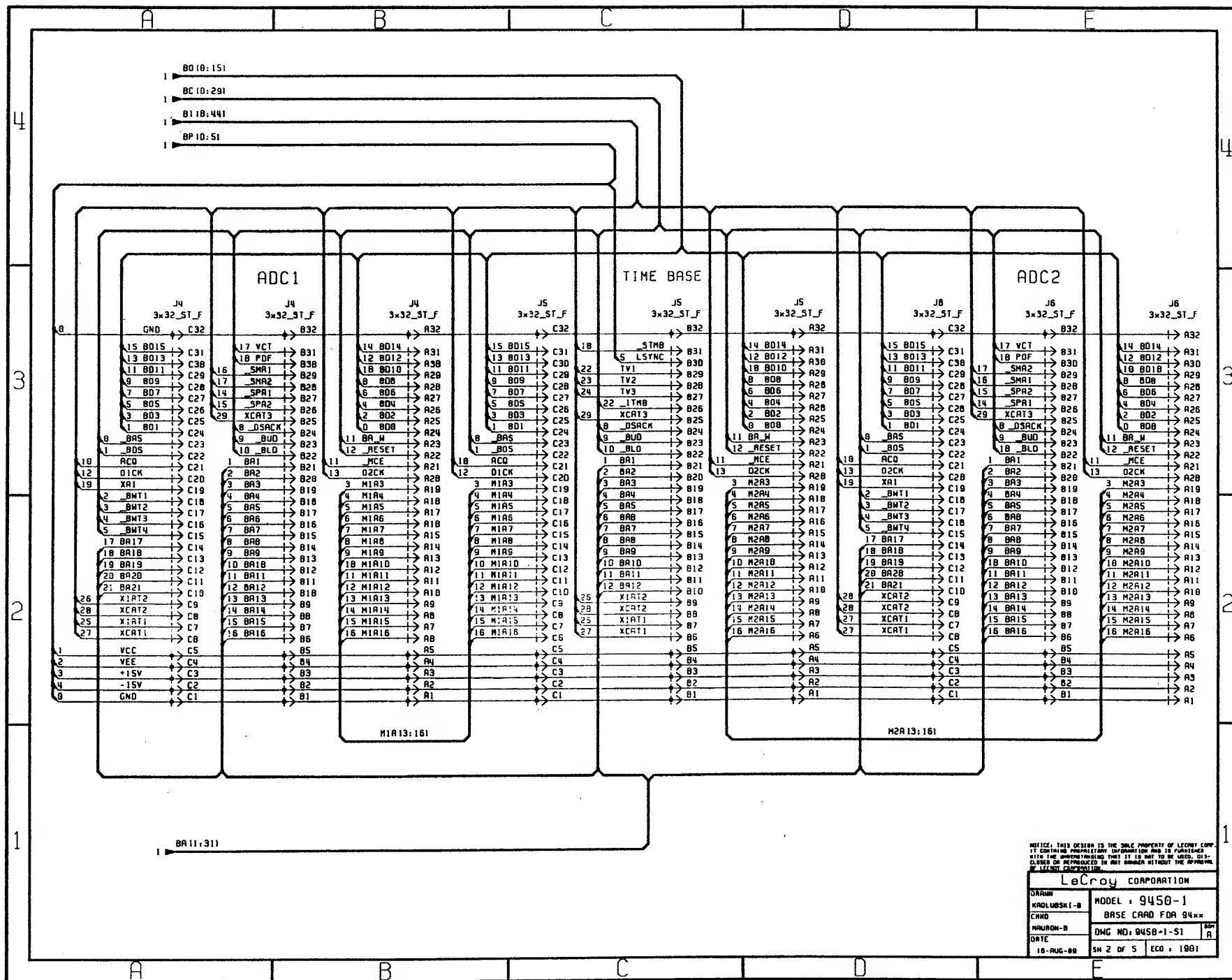






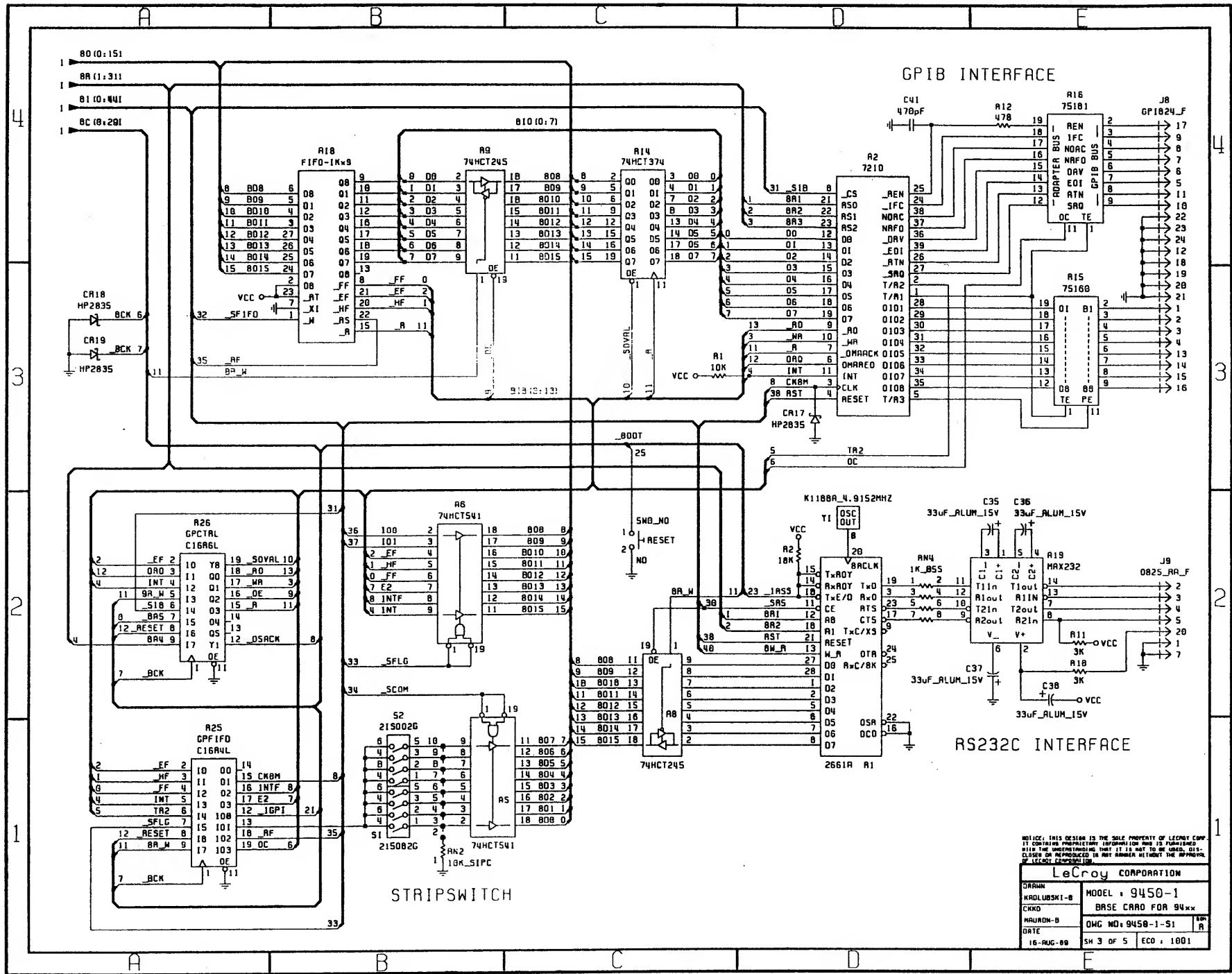
DSD 9450 Corrigé 15.1.88





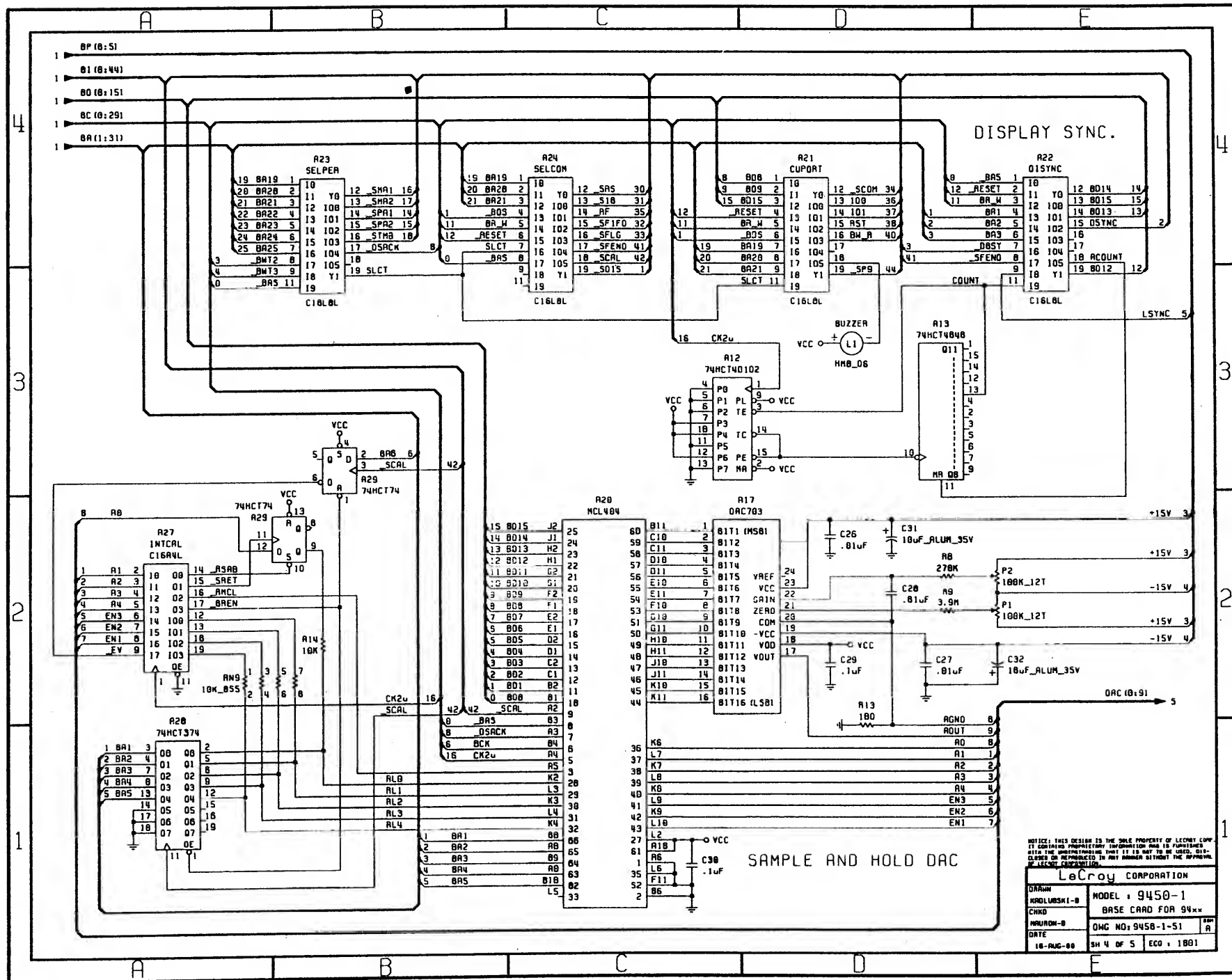
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LeCroy CORPORATION	
MODEL: 9450-1	BASE CARD FOR 94xx
DATE: 10-AUG-88	SH 2 OF 5 ECD: 1981



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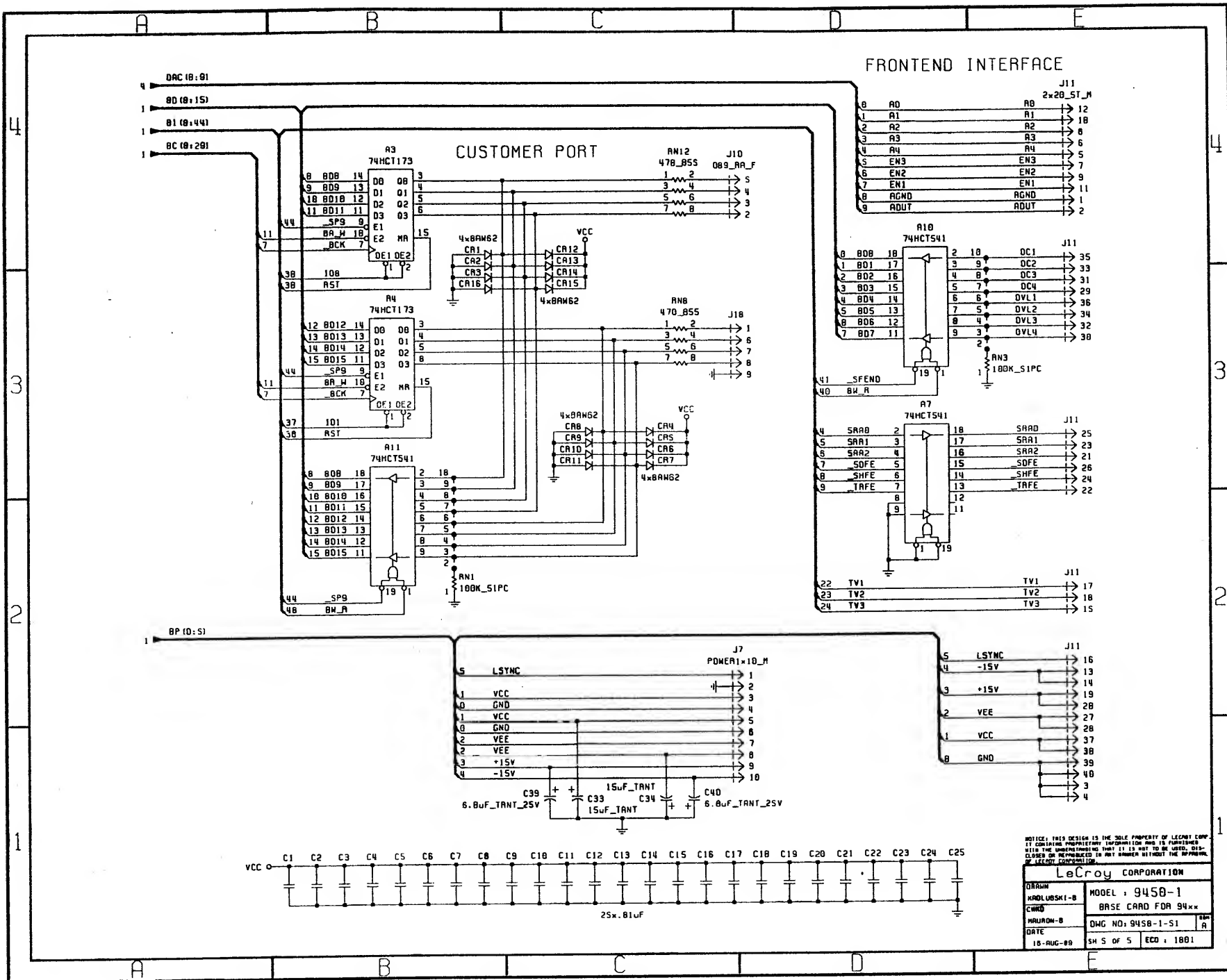
LeCroy CORPORATION	
DRAWN WADLUBSKI-B	MODEL: 9450-1
CK'D WADLUBSKI-B	BASE CARD FOR 94xx
DATE 16-AUG-88	OWC NO: 9450-1-S1 SH 3 OF 5 ECO: 1001



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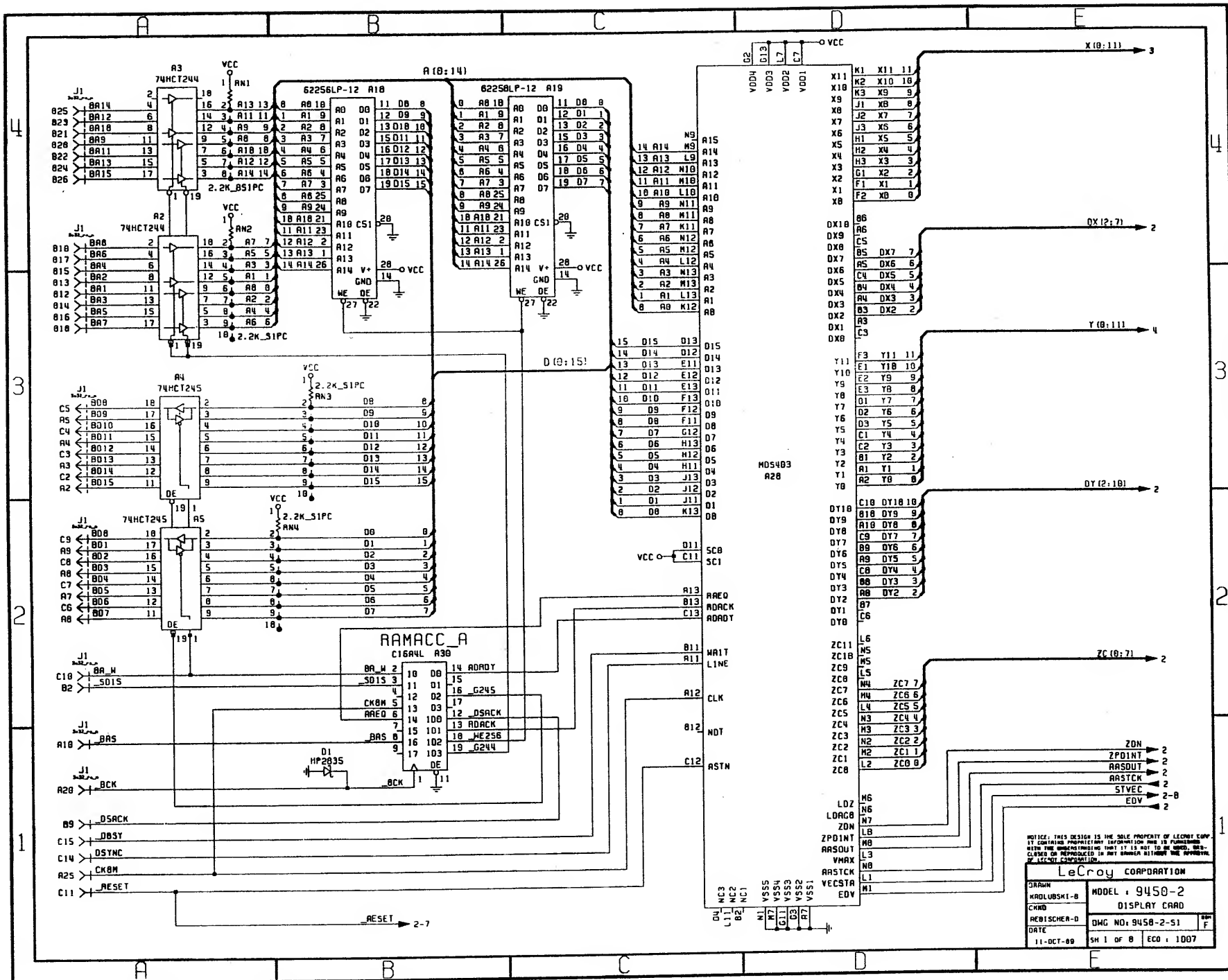
LeCroy CORPORATION			
DATE	18-AUG-88	SH 4 OF 5	ECO 1 1801
DRAWN	ADOLPHUSKI-B	MODEL	9450-1
CHECKED	ADOLPHUSKI-B	BASE CARD FOR	94xx
DATE	18-AUG-88	OWC NO:	9450-1-51

SAMPLE AND HOLD DAC



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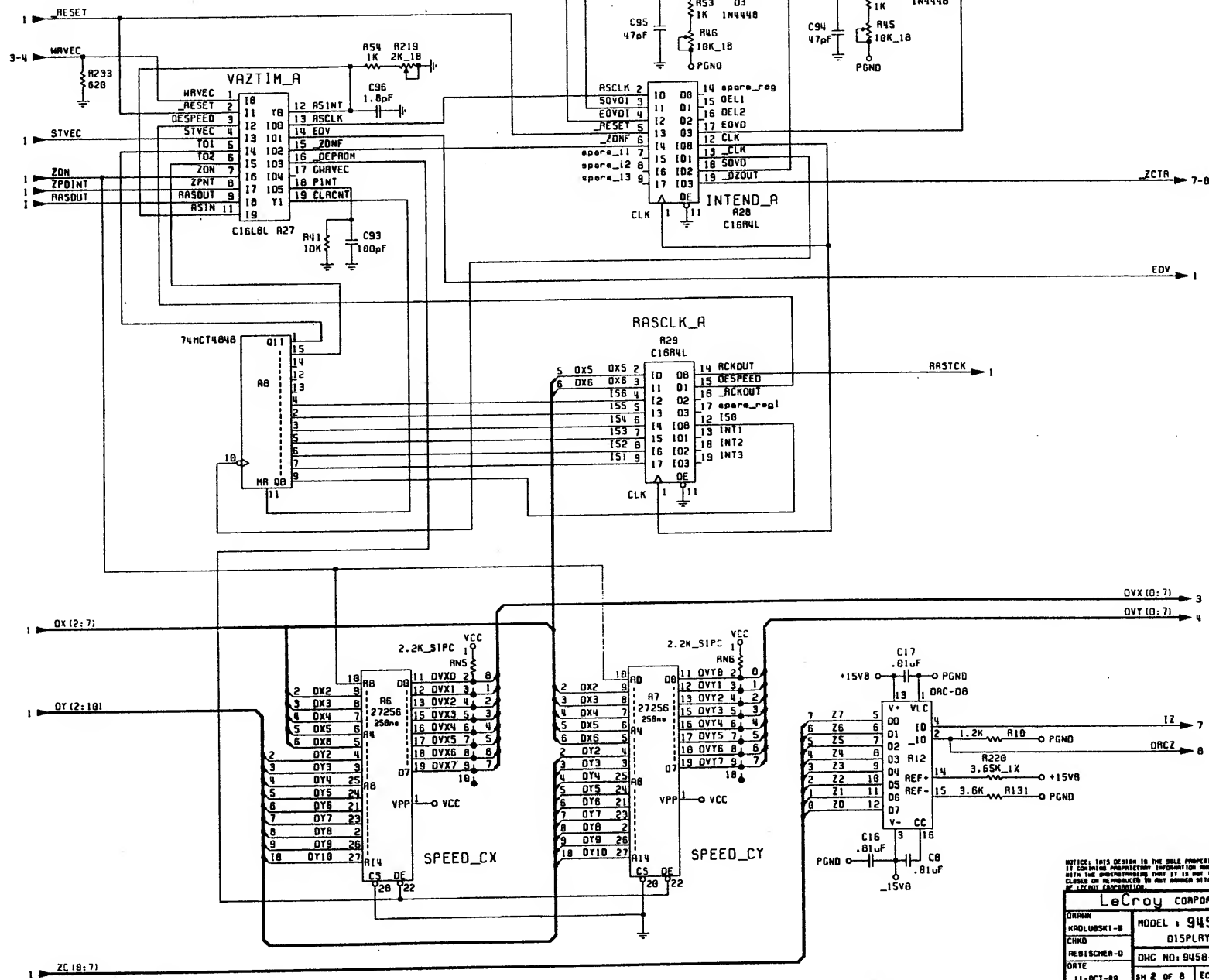
LeCroy CORPORATION	
DRAWN KADLUSKI-B	MODEL : 9458-1
CHG KADLUSKI-B	BASE CARD FOR 94xx
DATE 15-AUG-89	DWG NO: 9458-1-S1
	SH 5 OF 5 ECD : 1801



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**LeCroy CORPORATION**

DRAWN KROBUSHKI-B	MODEL : 9450-2
CKED REBISCHER-D	DISPLAY CARD
DATE 11-OCT-89	DWG NO: 9450-2-51
	SH 1 OF 8 ECO : 1007



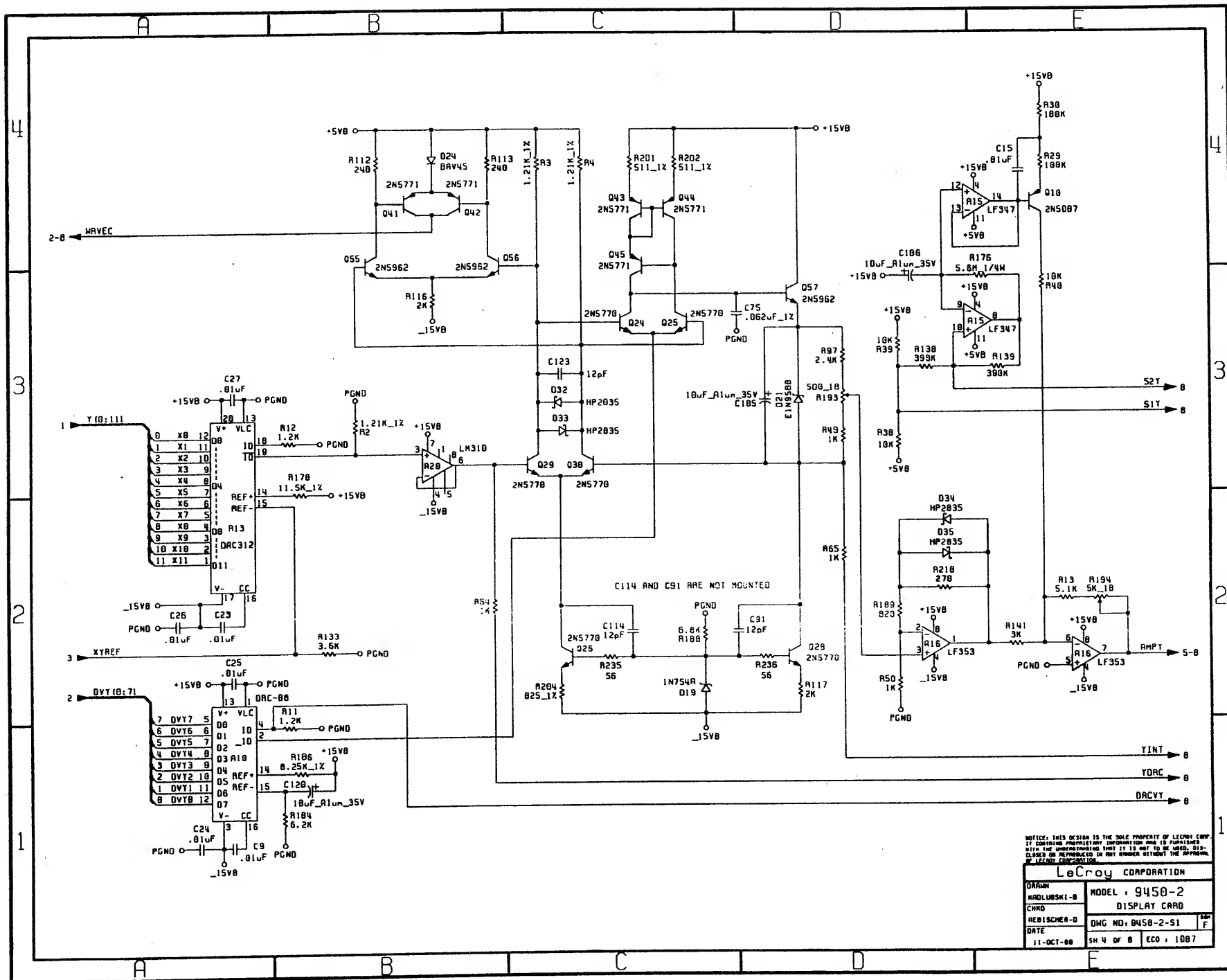
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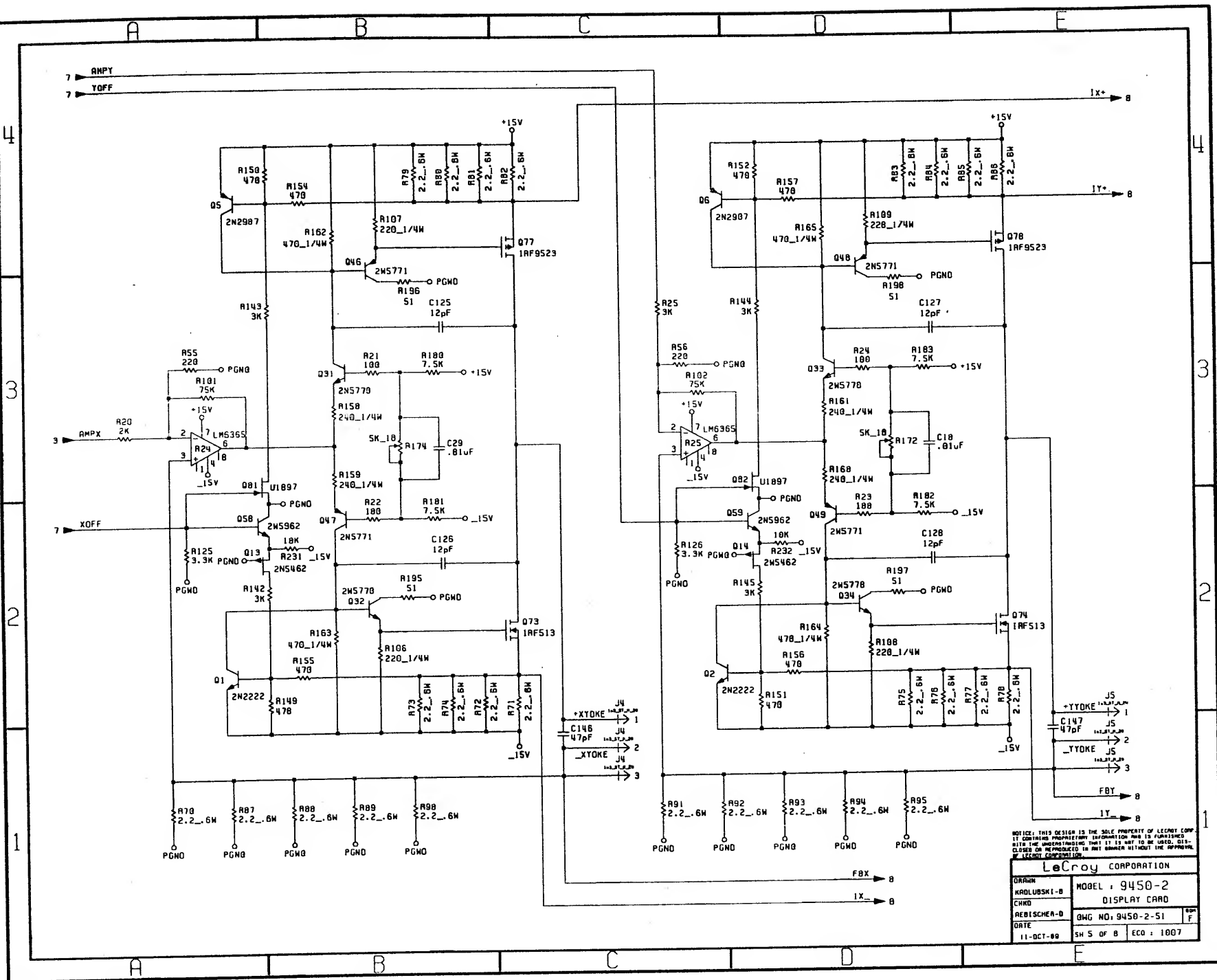
**LeCroy CORPORATION**

DRN	MODEL: 9450-2	REV	1
CHND	DISPLAY CARD	DWG NO:	9450-2-51
DATE	11-OCT-88	SH 2 OF 8	ECO: 1887



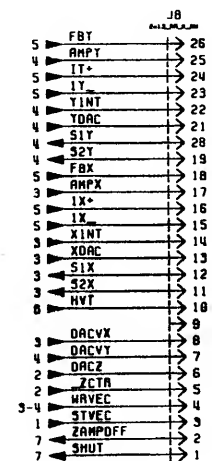
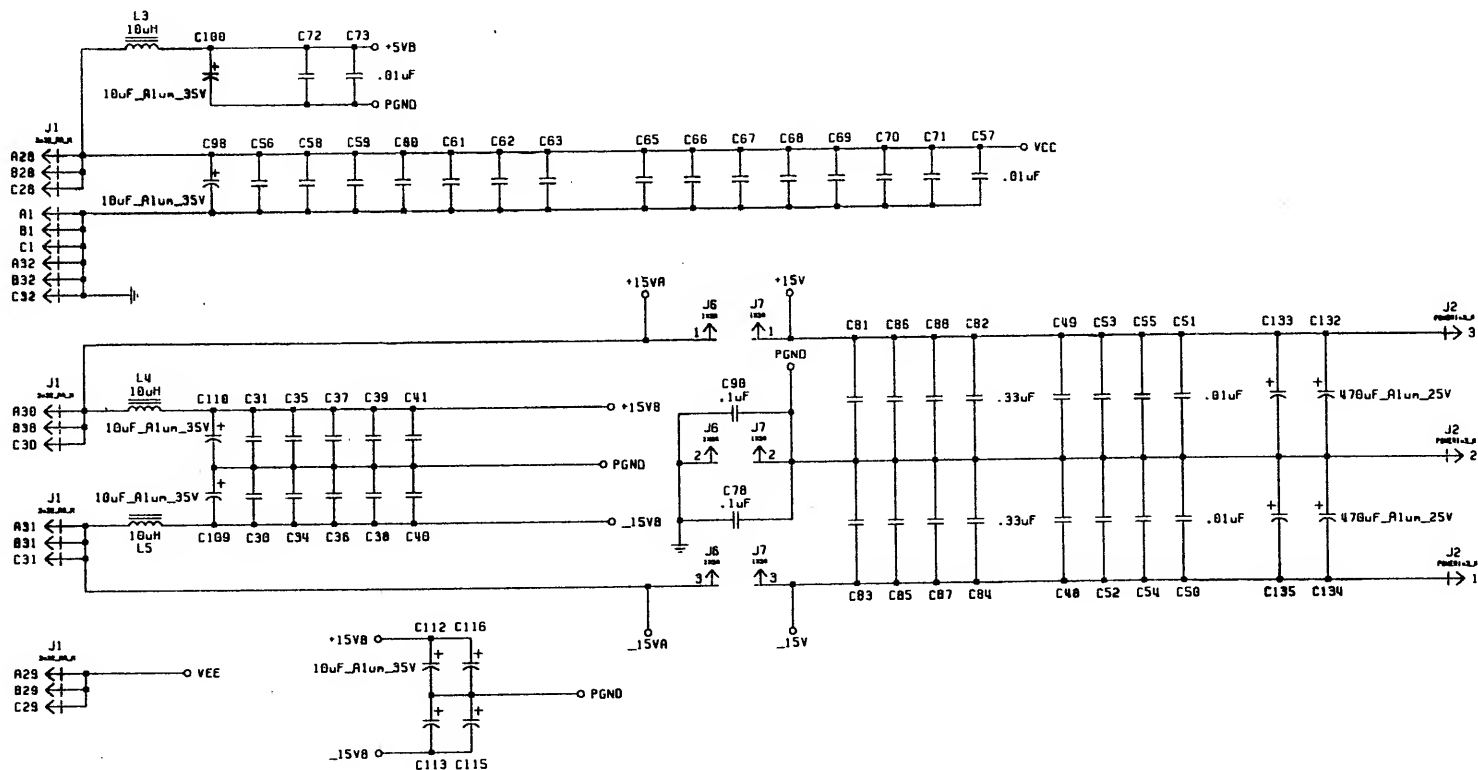






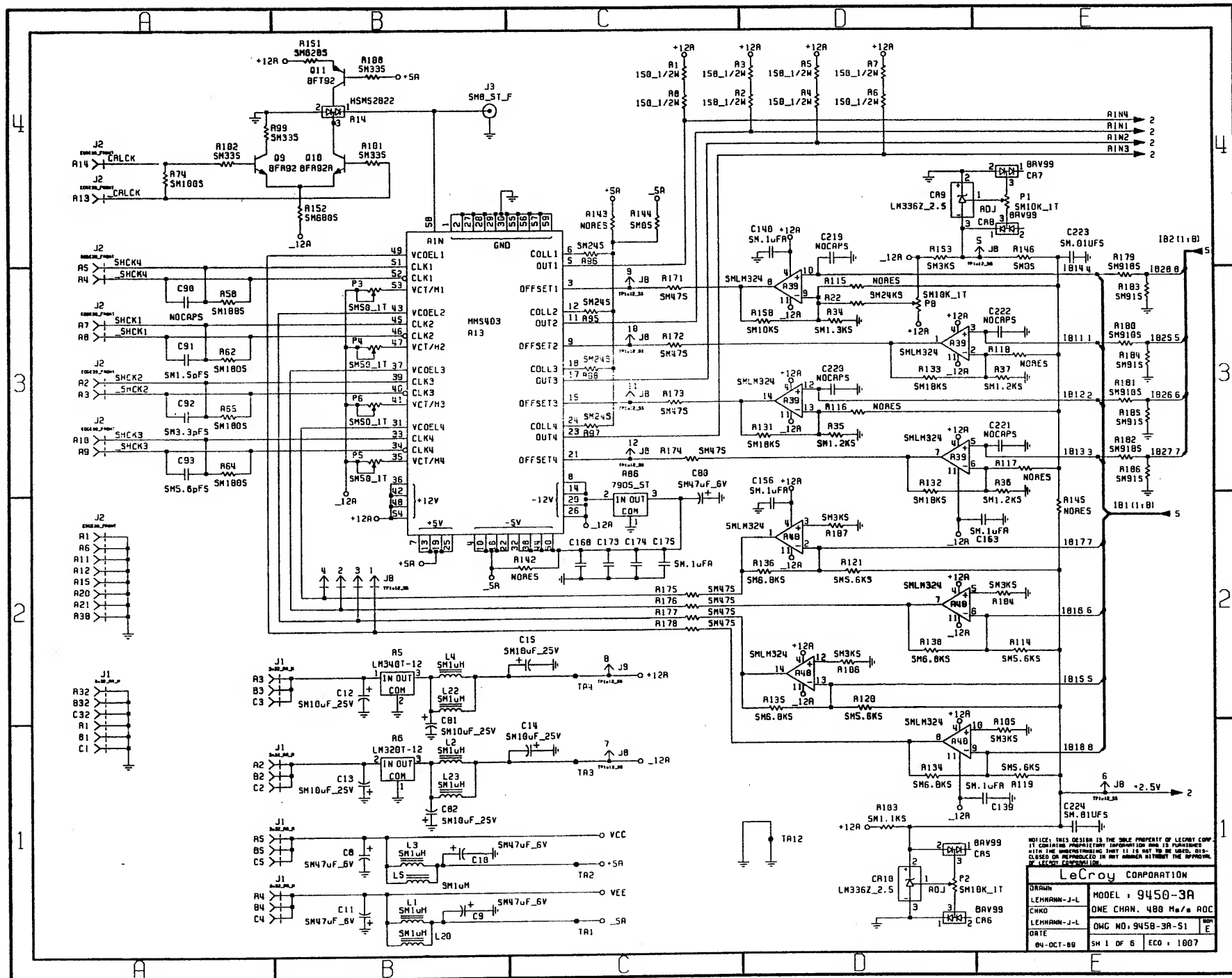






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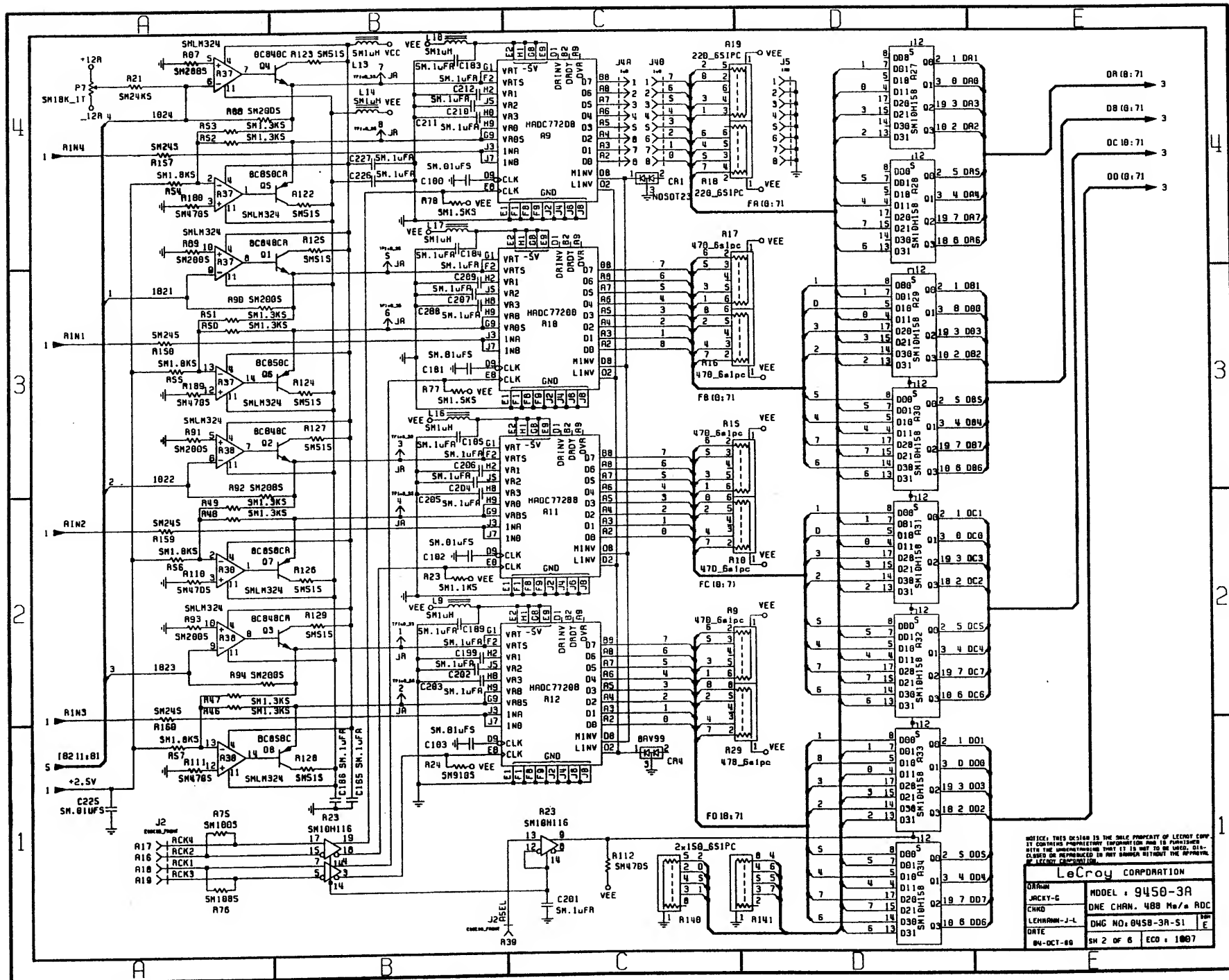
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DRAWN	MODEL: 9450-2
CHKD	DISPLAY CARD
REVISOR-D	DWG NO: 9450-2-51
DATE	11-OCT-80
SH 8 OF 8	ECO: 1987



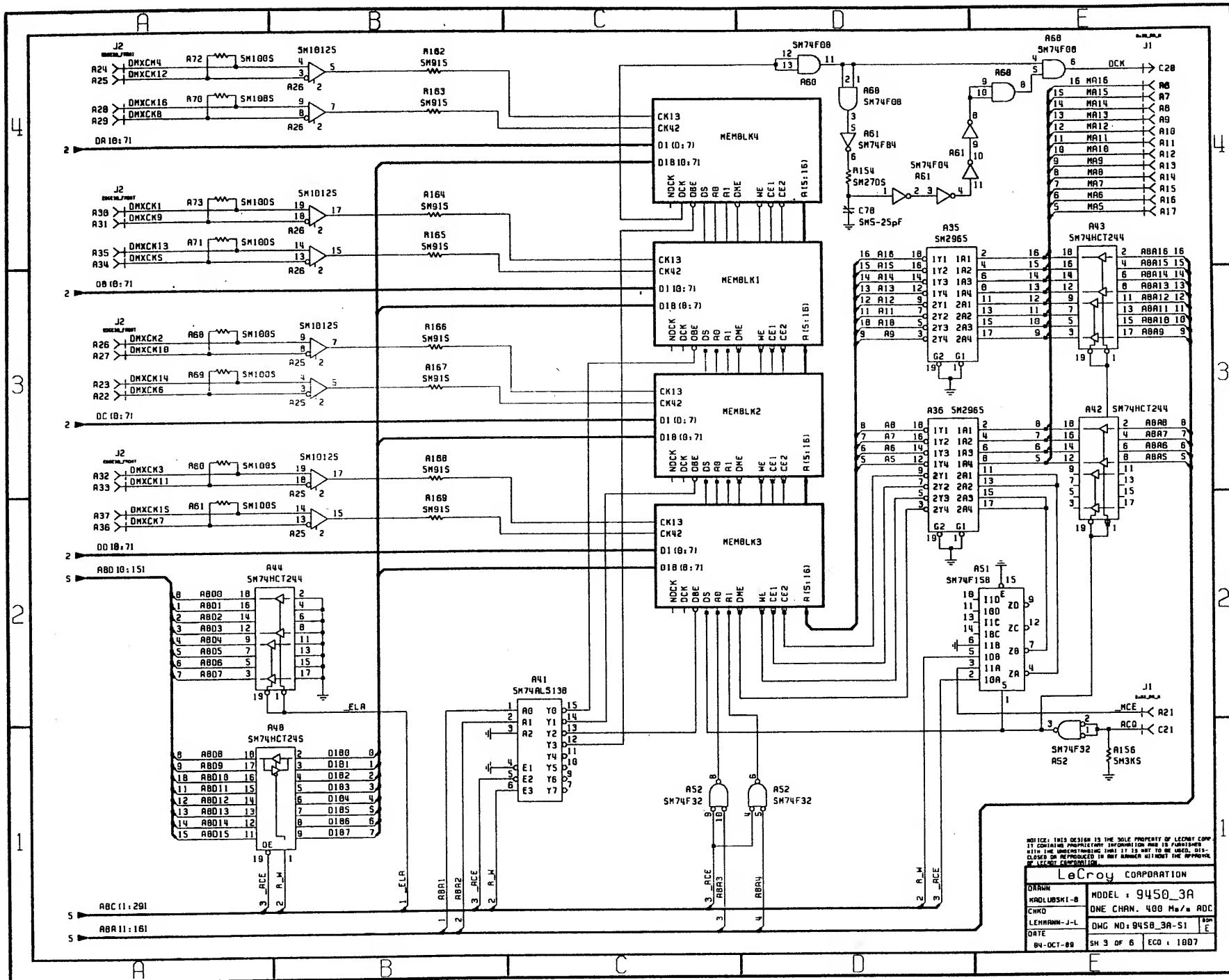
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**LeCroy CORPORATION**

DESIGN	LEHMAN-J-L	MODEL: 9450-3A
CHECK	LEHMAN-J-L	ONE CHAN. 488 M <sub>0</sub> /s ROC
DATE	84-OCT-80	QWG NO. 9450-3A-S1
		SH 1 OF 6 ECO: 1807



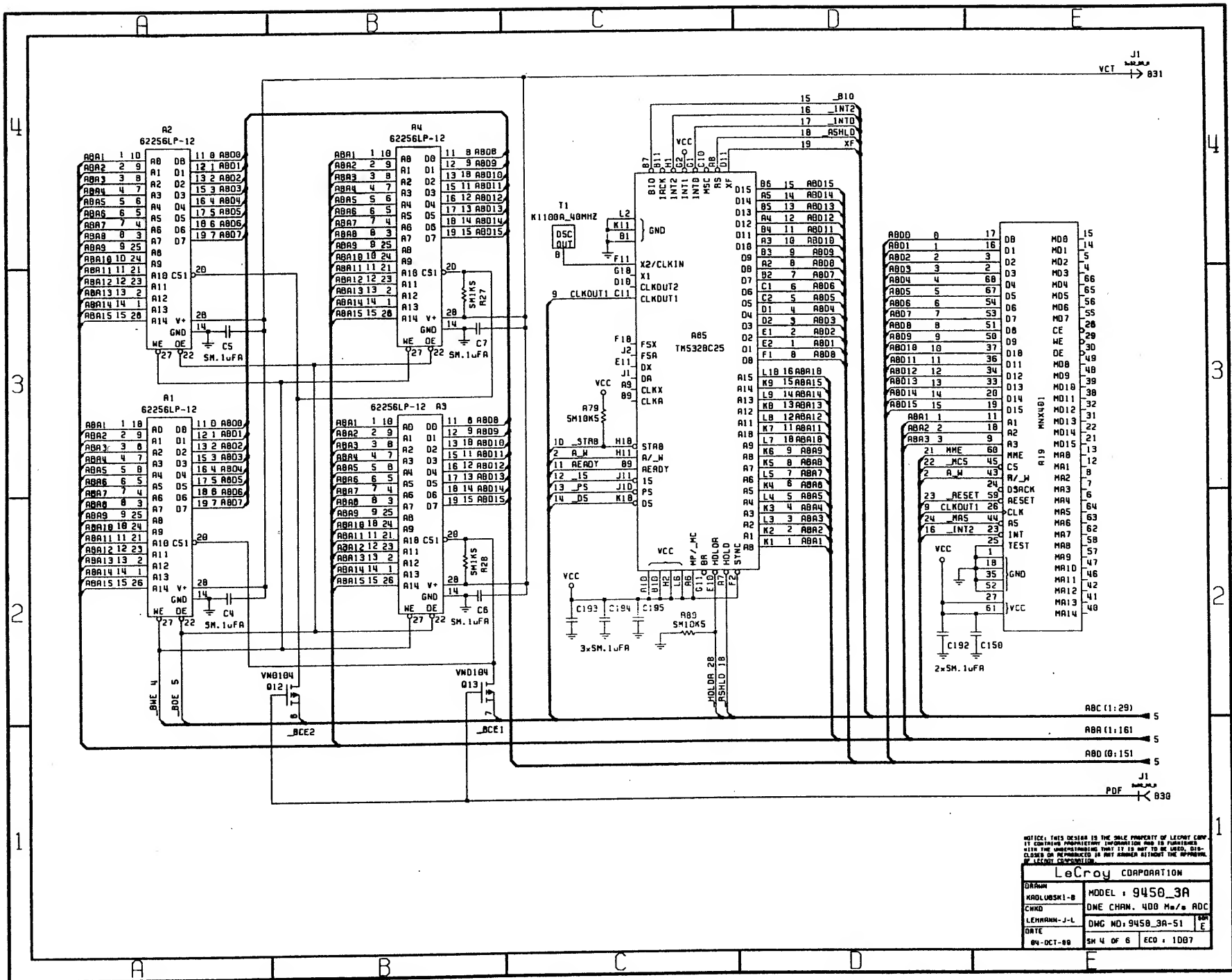




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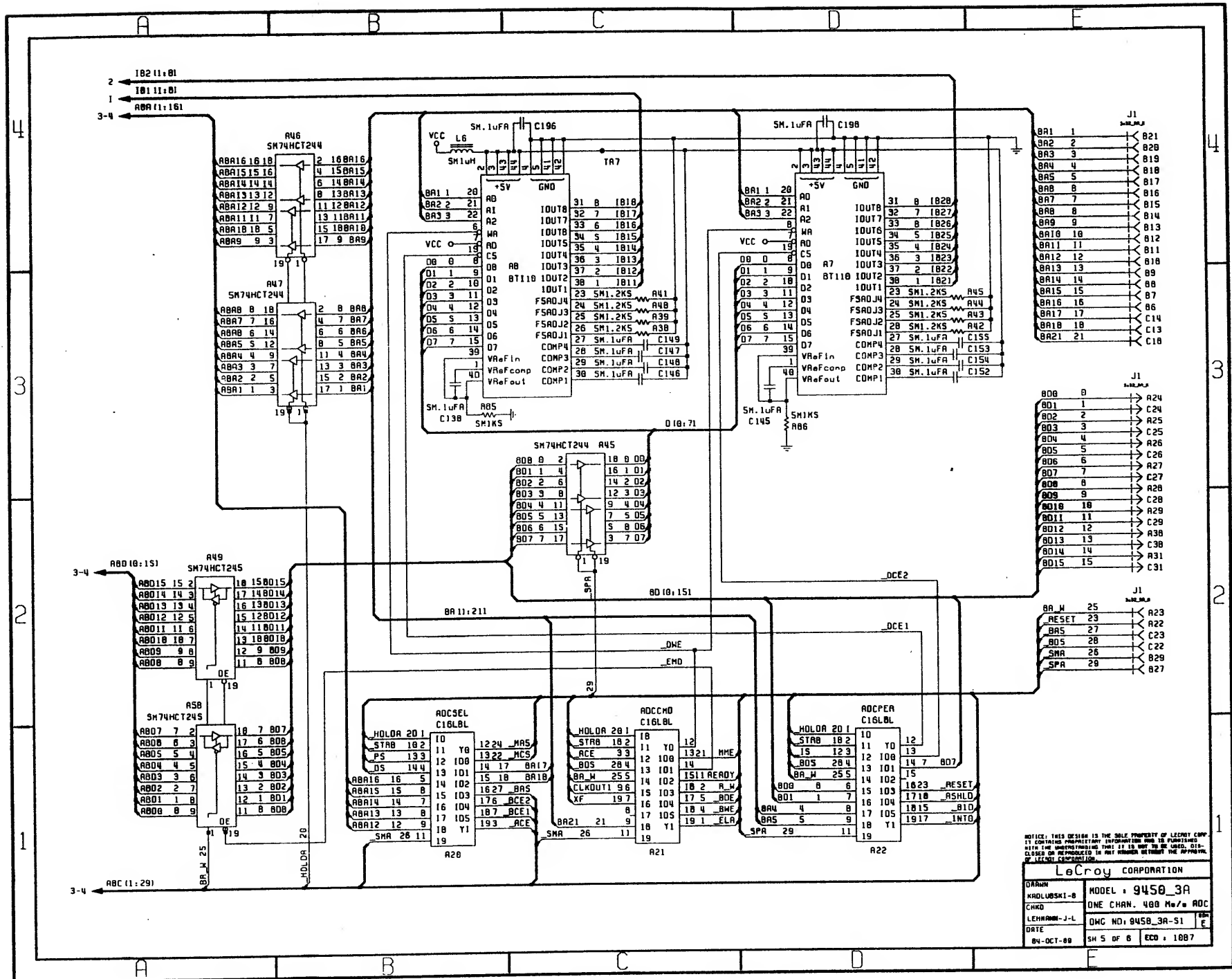
**LeCroy CORPORATION**

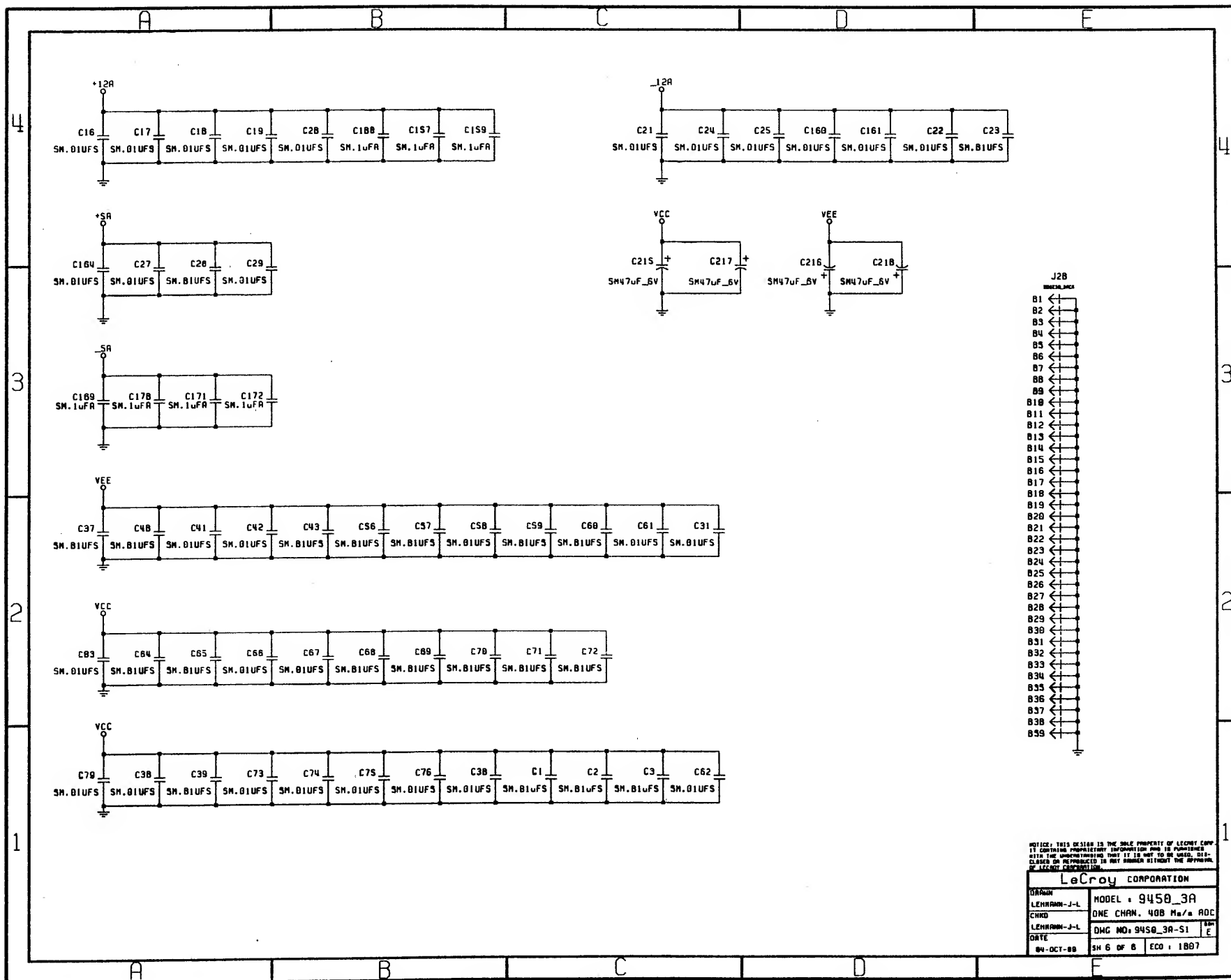
DRAWN RADLOWSKI-B CHKD LEHMAN-J-L DATE 04-OCT-88	MODEL: 9450_3A ONE CHAN. 400 Mhz ADC DWG NO: 9450_3A-S1 SH 3 OF 6 ECO: 1087
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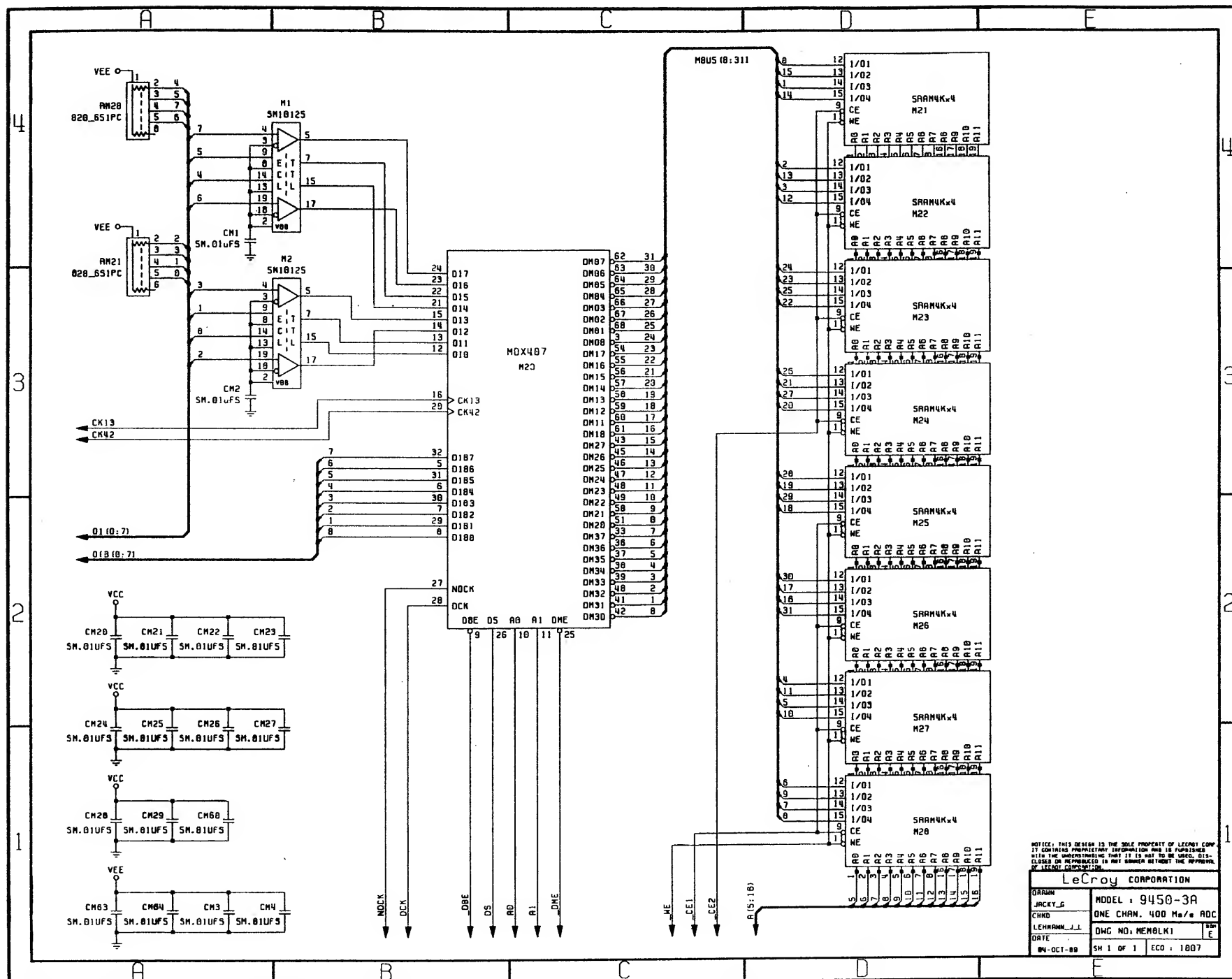


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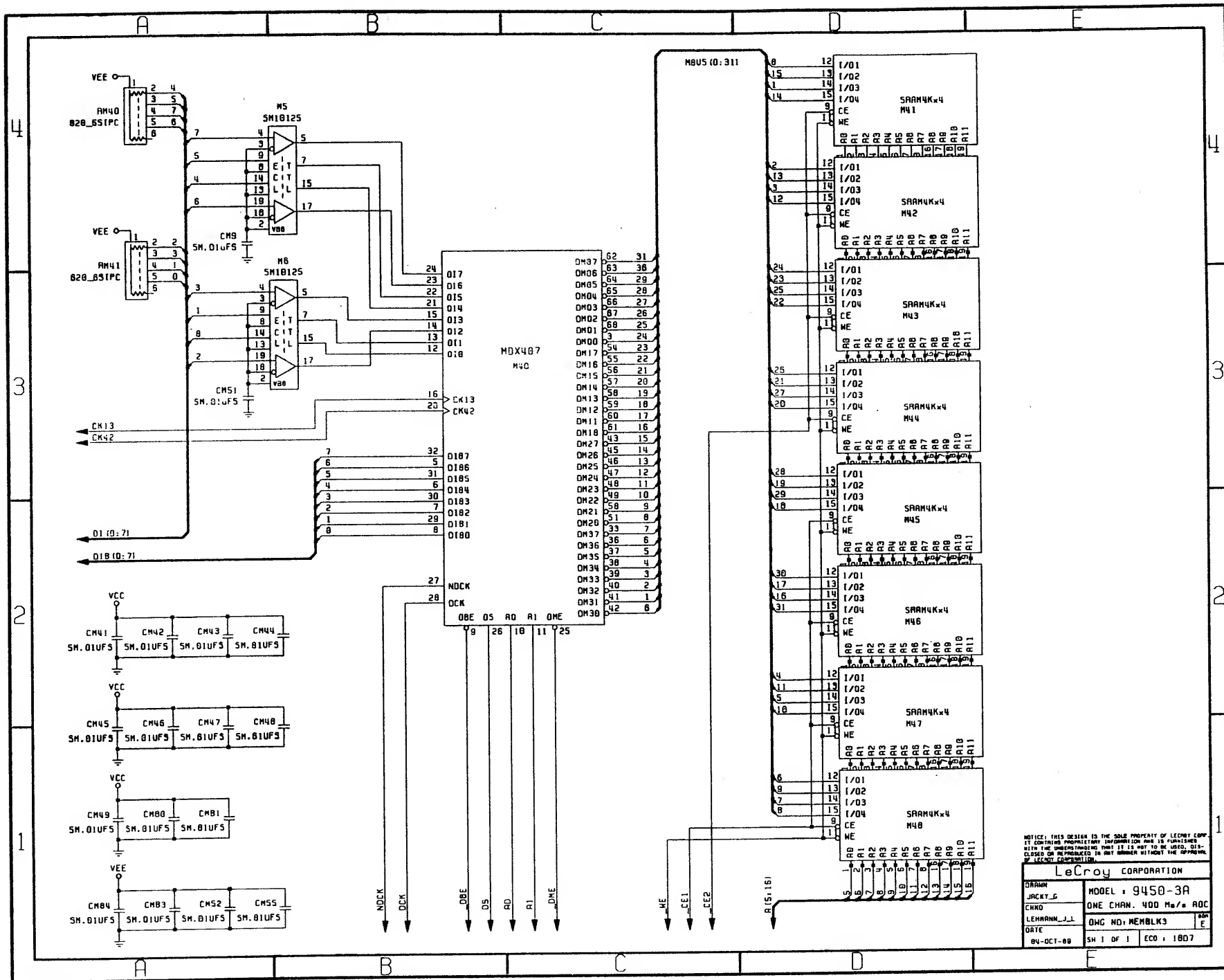
LeCroy CORPORATION	
DATE	04-DEC-88
MODEL	9450_3A
DWG NO.	9450_3A-51
SH 4 OF 6	ECO : 1087

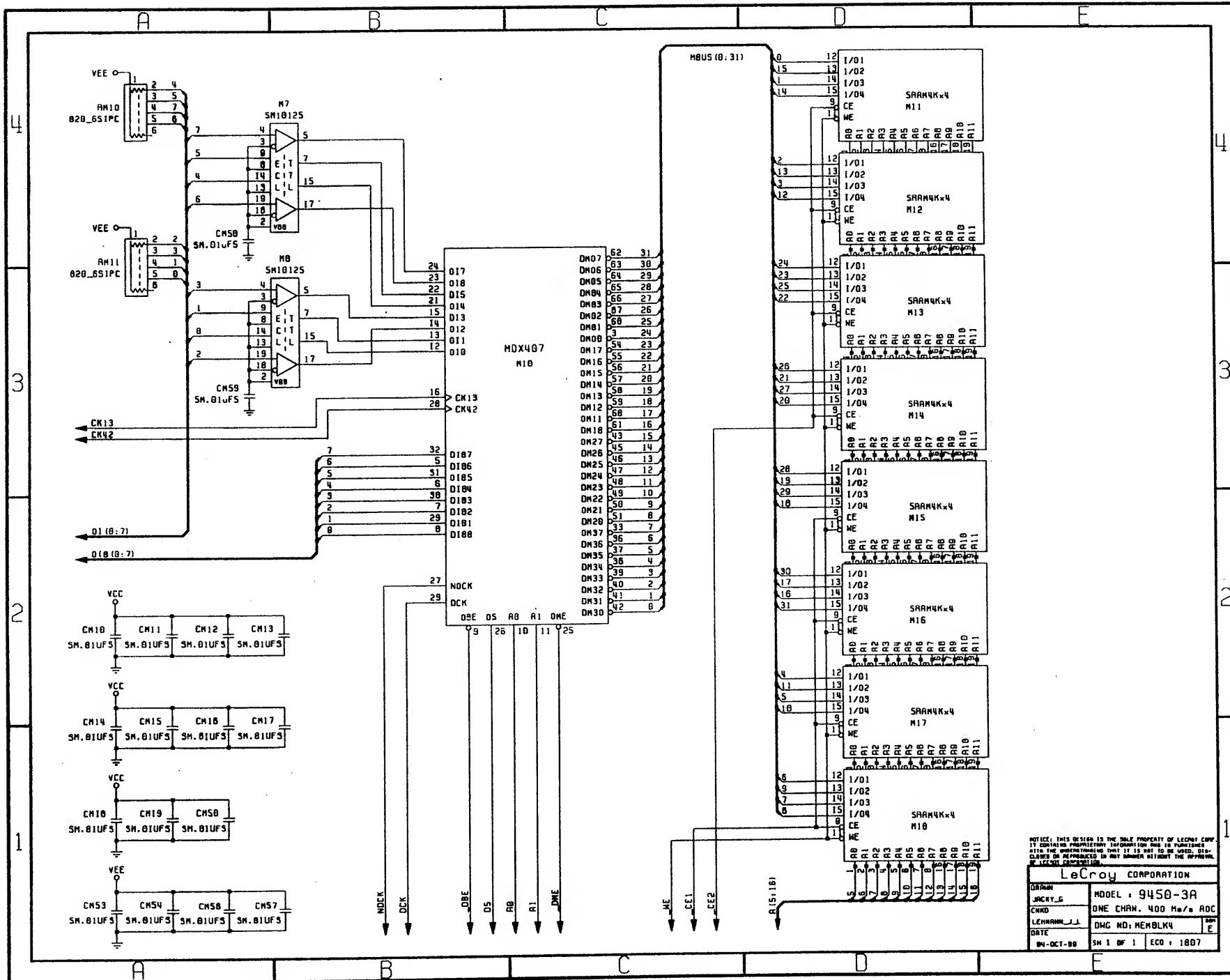








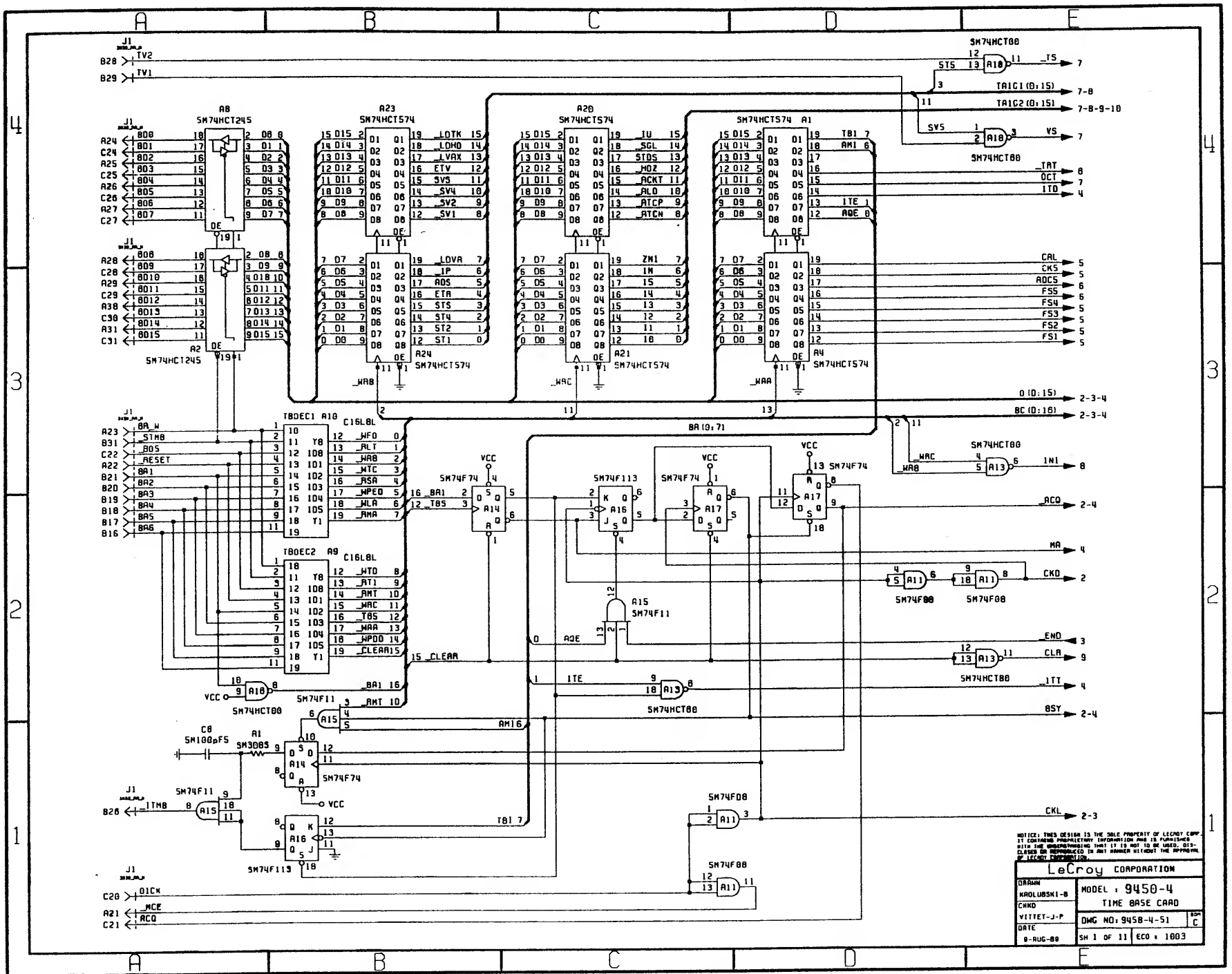


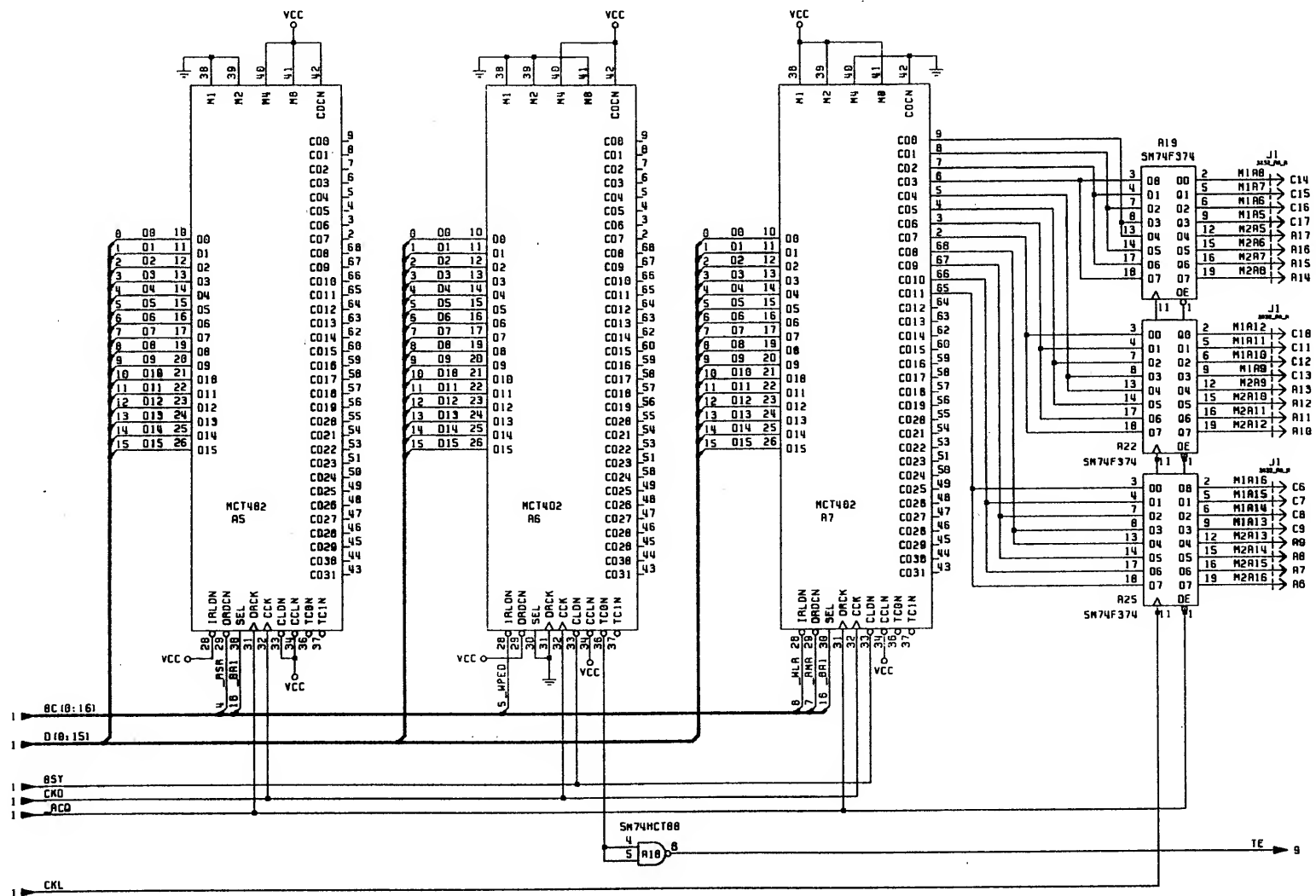


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LeCroy CORPORATION	
DESIGN JACKY_G	MODEL : 9450-3A
CNCD LEHMAN	ONE CHAN. 400 Ma/μs ROC
DATE 04-OCT-88	DWG NO: MEMBLK4
SH 1 OF 1	ECO : 1887



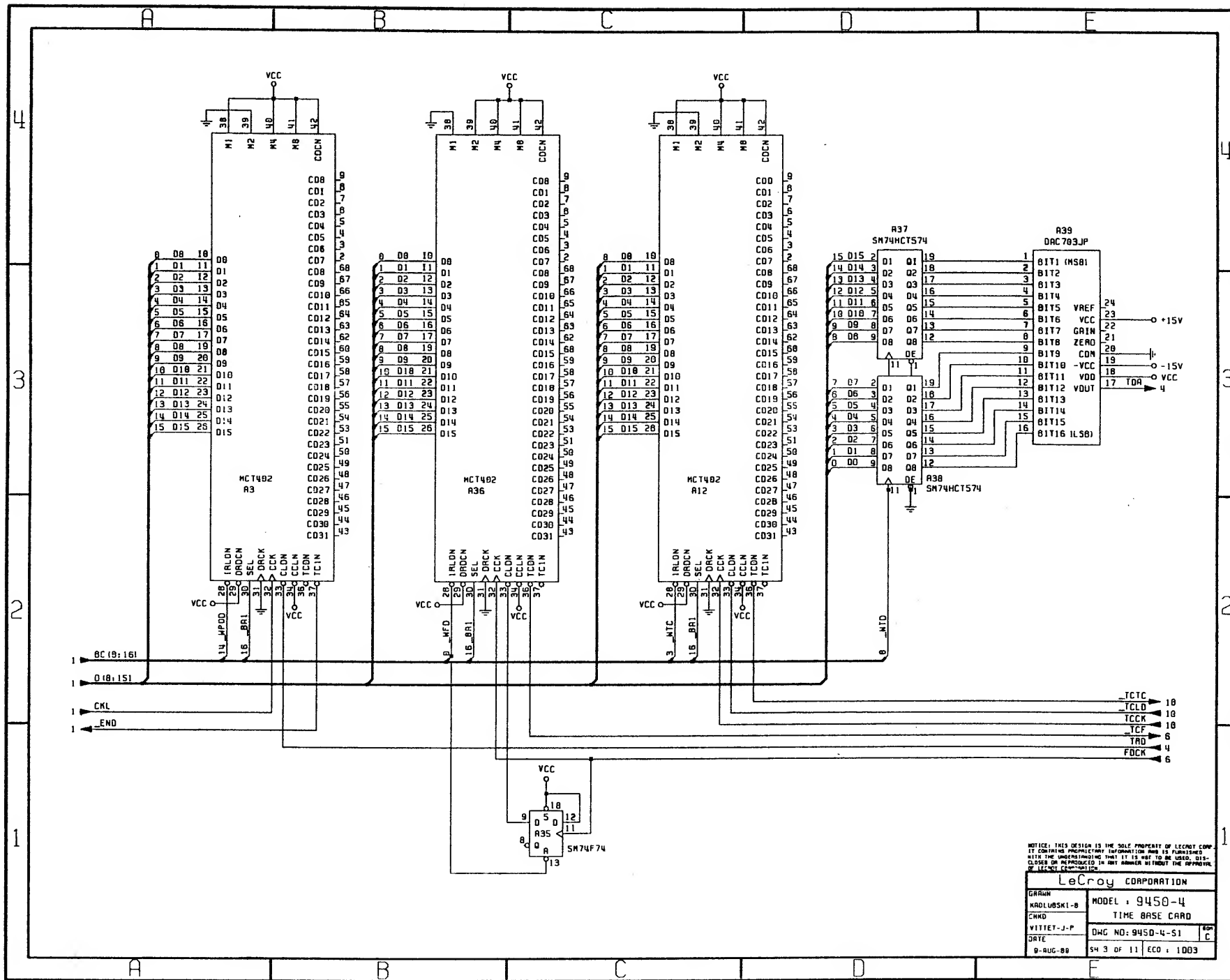




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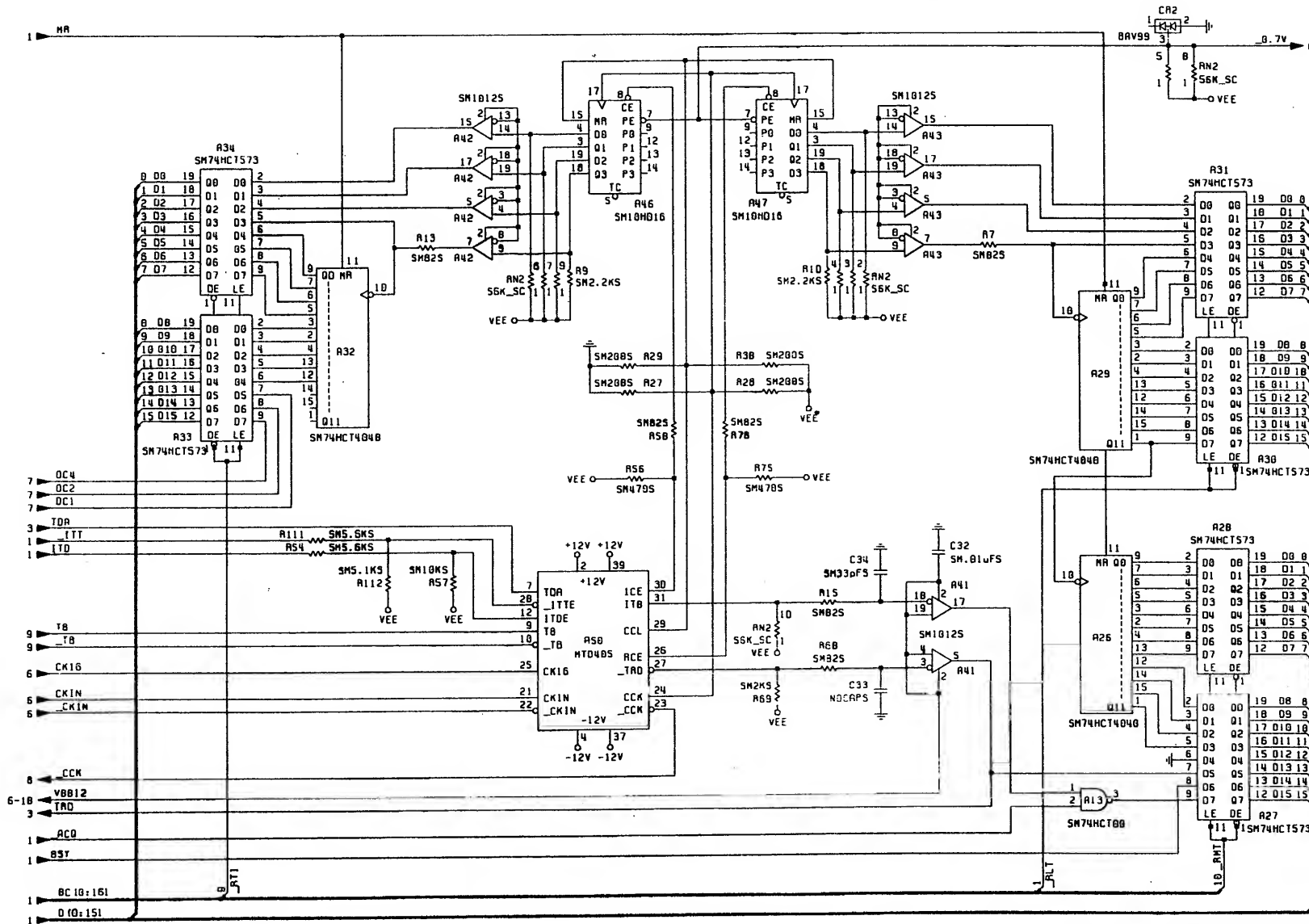
DESIGN	MODEL: 9450-4
REVISION	TIME BASE CARD
DATE	DMC NO. 9450-4-51
8-AUG-88	SH 2 OF 11 ECD - 1983



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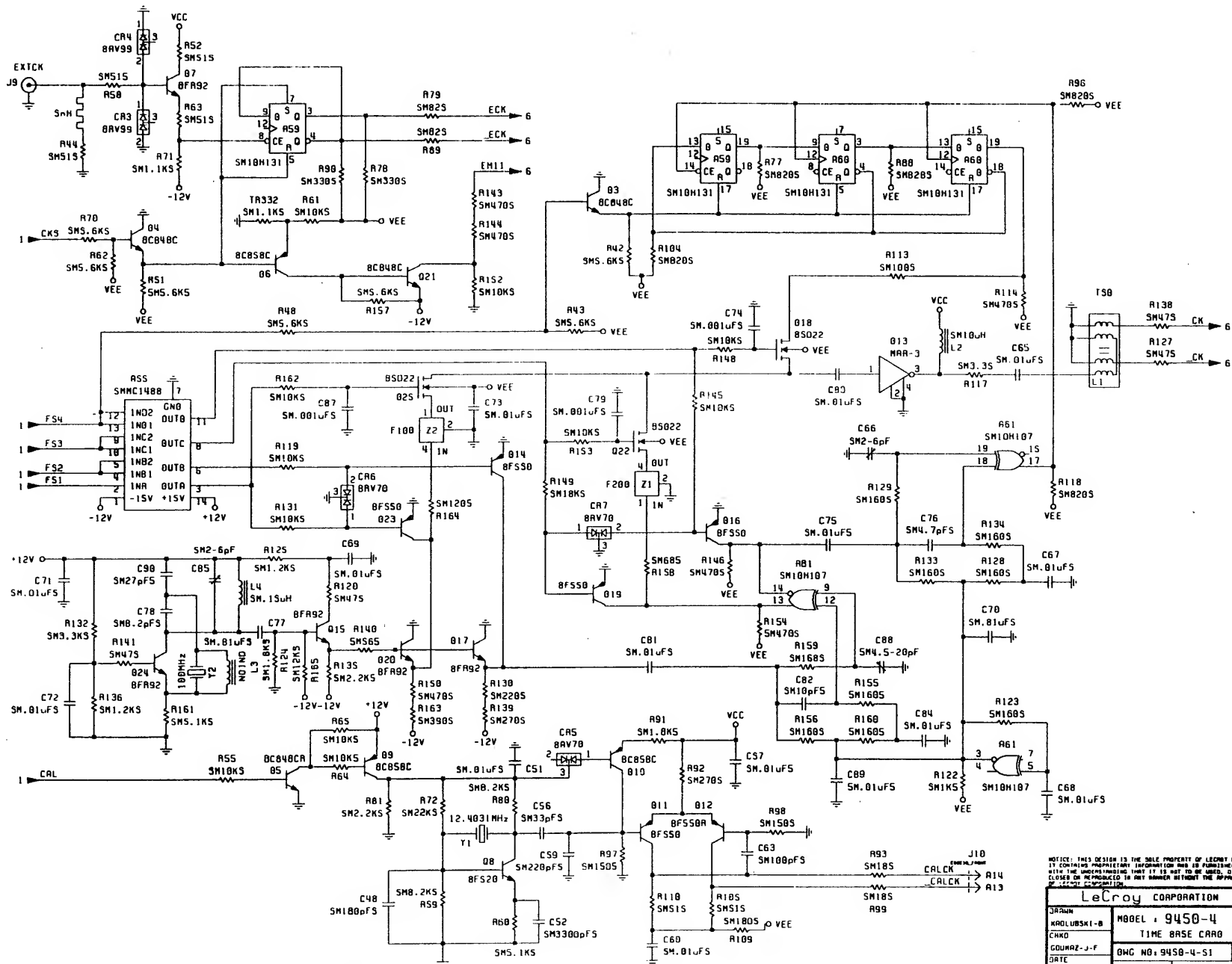
GRAPH	MODEL: 9450-4
KADLUBSKI-B	TIME BASE CARD
CHWD	DWG NO: 9450-4-S1
WITTET-J-P	DATE
9-AUG-88	54 3 OF 11 ECO: 1003



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LeCroy CORPORATION

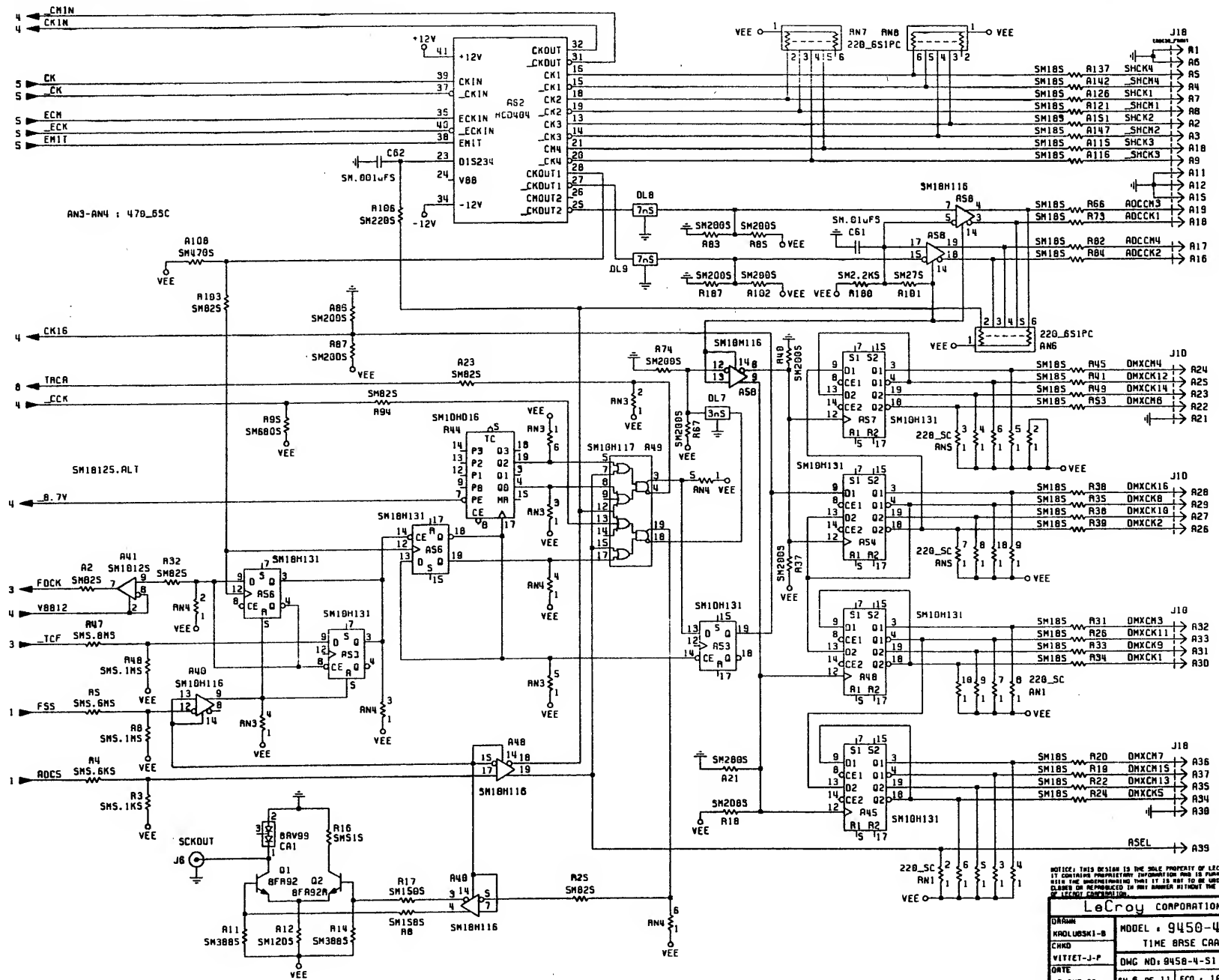
DRWING	MODEL: 9450-4
DATE	TIME BASE CARD
CHKD	DMG NO: 9450-4-51
DATE	SH 4 OF 11 ECD: 1003



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**LeCroy CORPORATION**

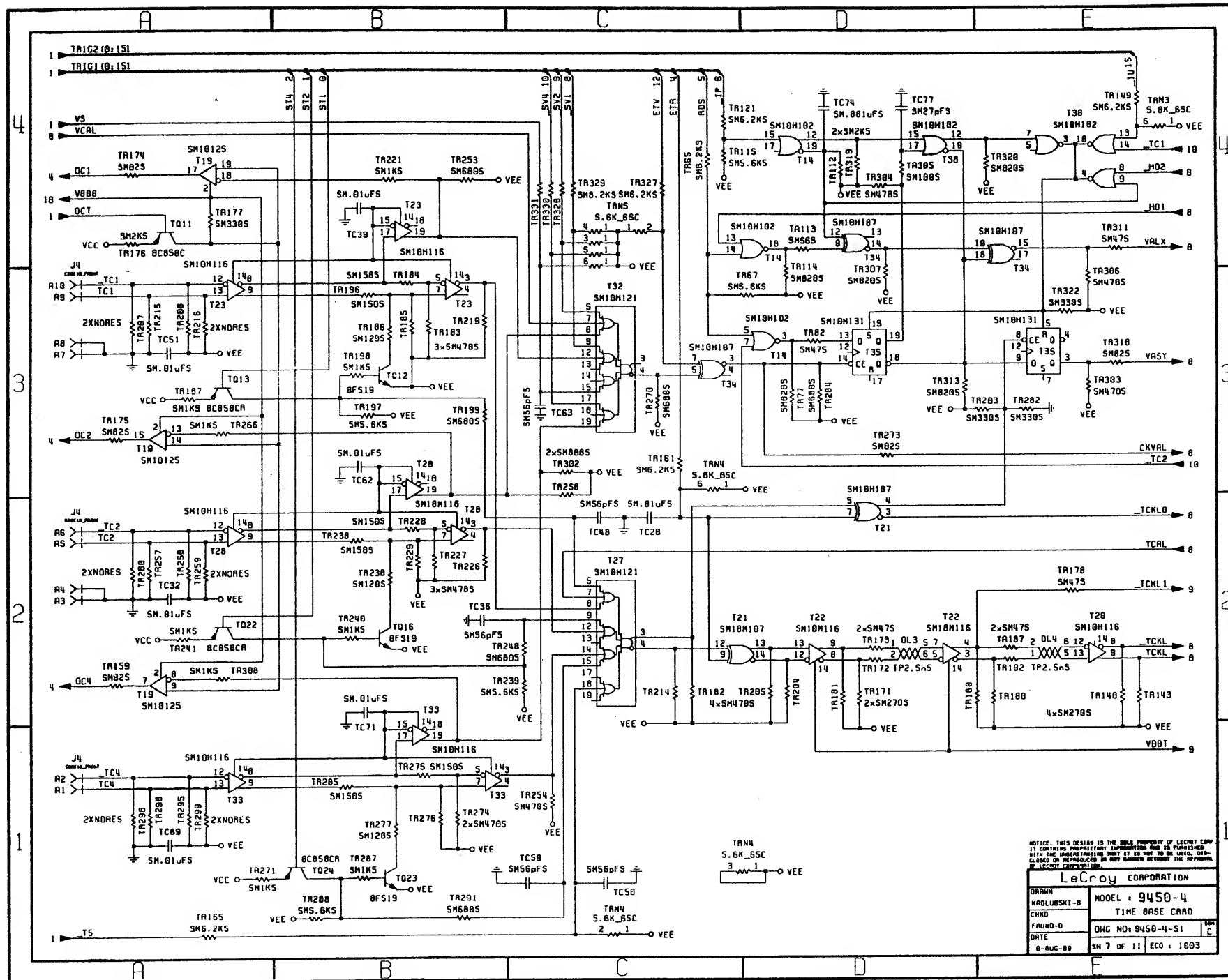
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CHNO	TIME BASE CRO
GOVARR-J-F	BWG NO. 9450-4-S1
DATE	8-AUG-89
	SH 5 OF 11 ECD : 1003

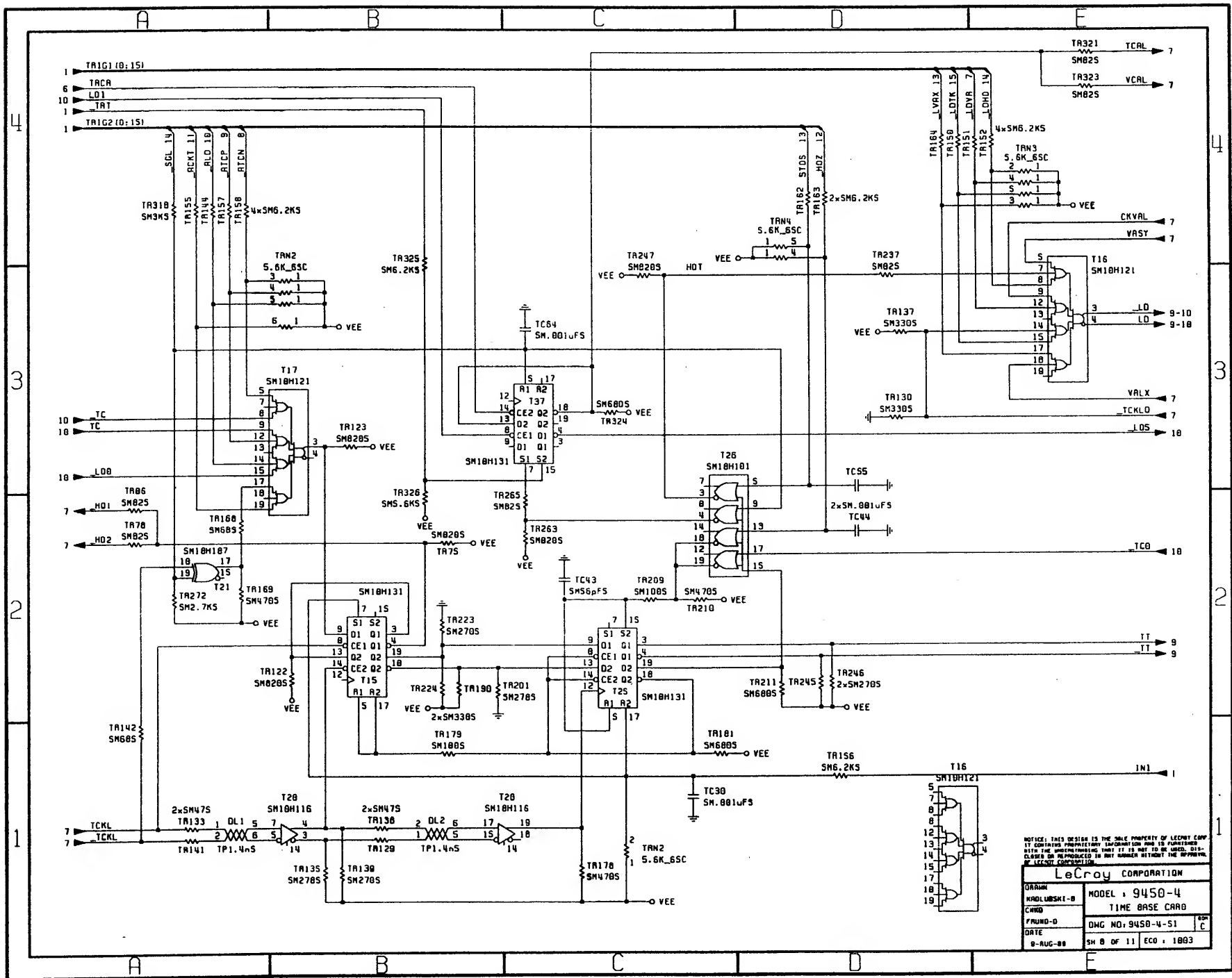


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**LeCroy CORPORATION**

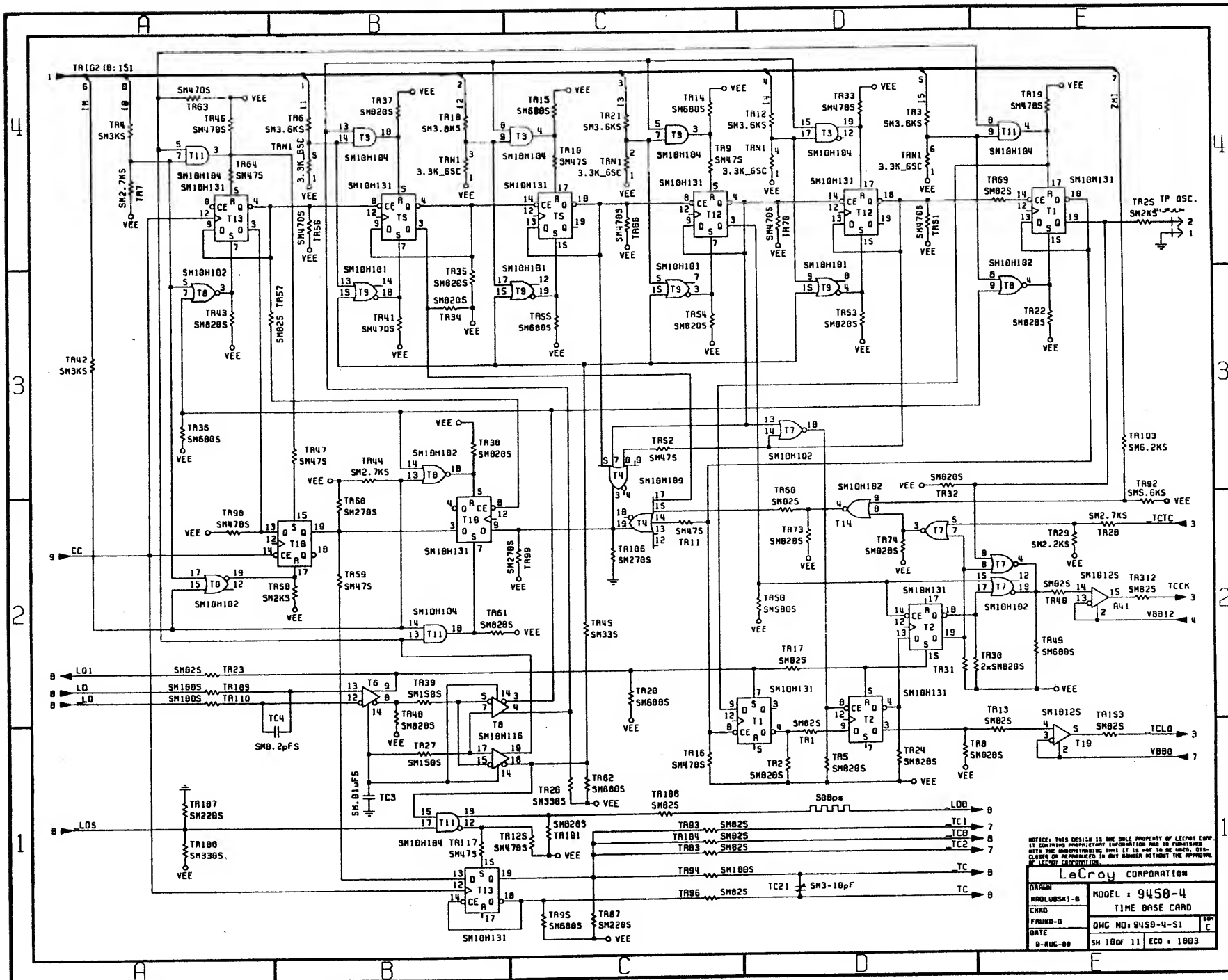
DRAWN KROULSKI-B CHKD VITTIET-J-P DATE 8-AUG-88	MODEL: 9450-4 TIME BASE CARD DWG NO: 9450-4-S1 SH 6 OF 11 ECO: 1883	REV C
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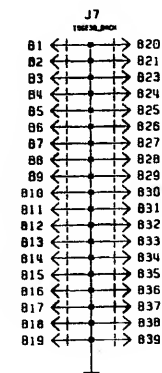
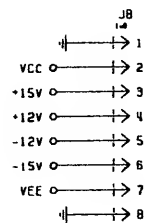
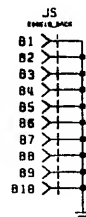
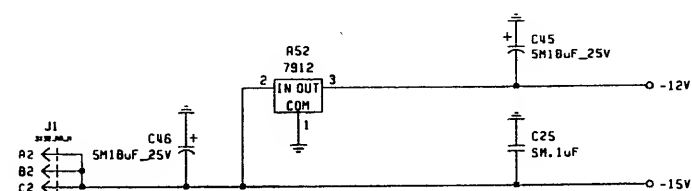
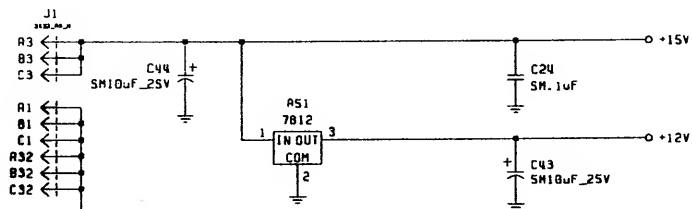
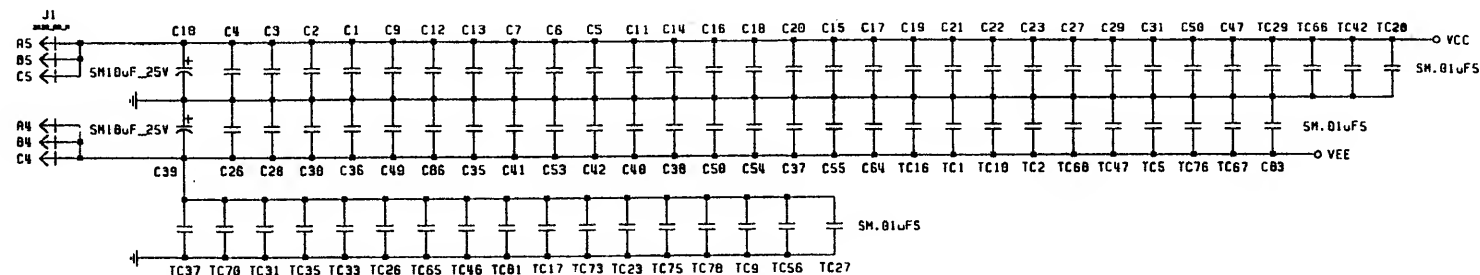






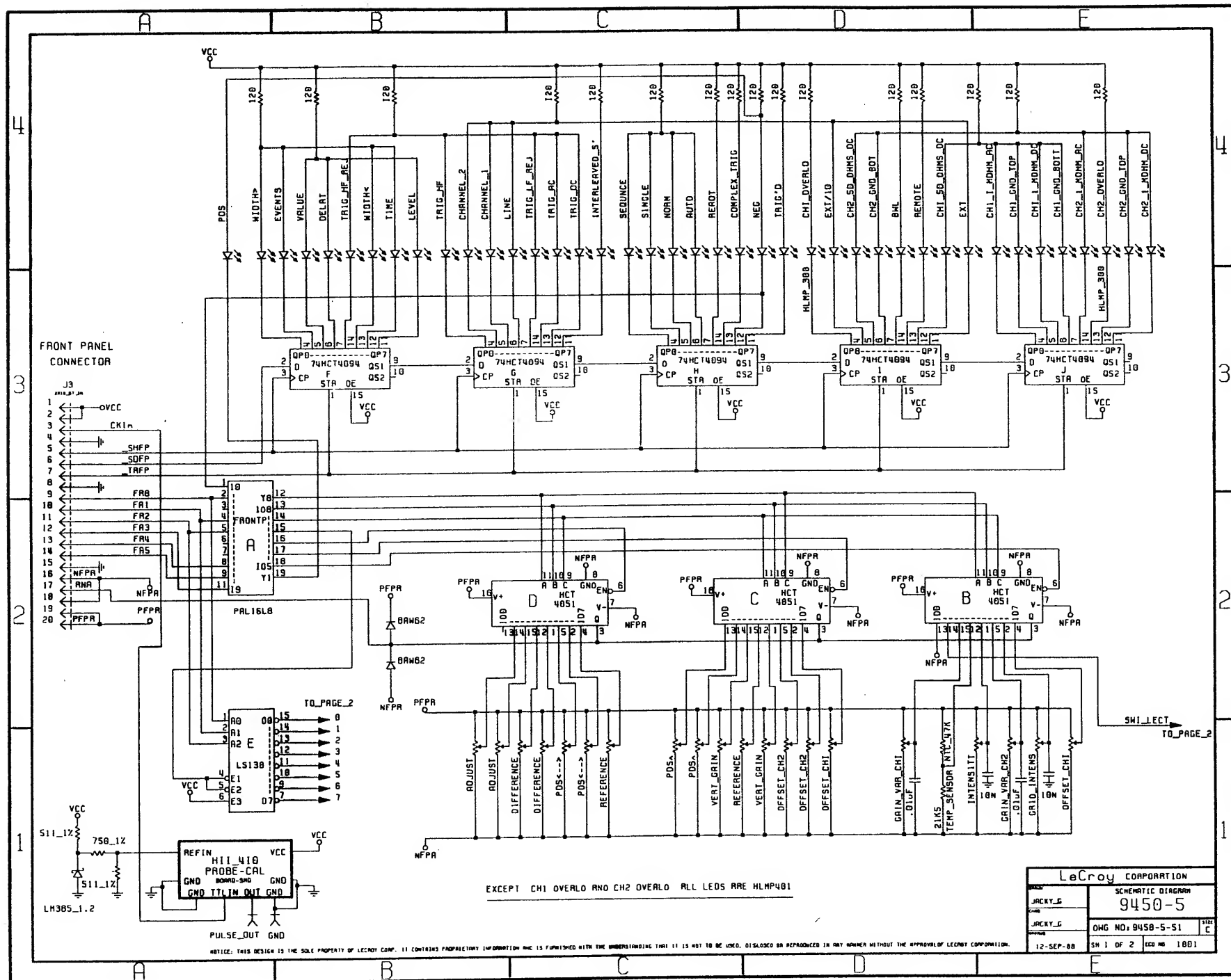


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<h1 style="text-align: center;">LeCroy CORPORATION</h1>	
DRAWING KADOLWSKI-B	MODEL : 9450-4 TIME BASE CARD
CIND FOUND-D	QWC NO: 9450-4-S1
DATE 8-AUG-88	SH 180F 11 ECO : 1803

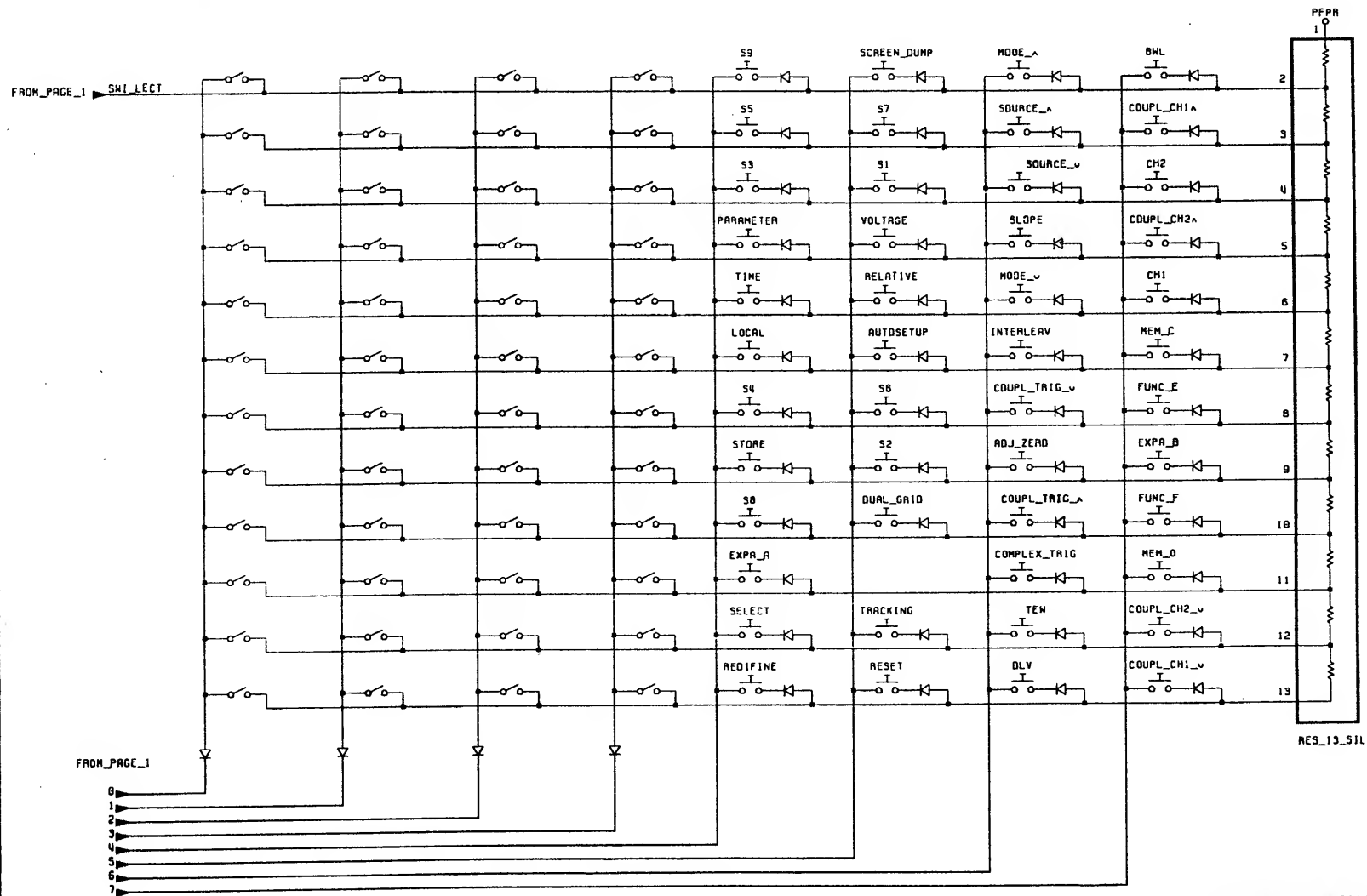


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LeCroy CORPORATION	
DESIGN	MODEL + 9450-4
DRW	TIME BASE CARD
CHKD	DATE
VITTEY-J-P	DATE
DATE	DATE
9-AUG-80	9-AUG-80



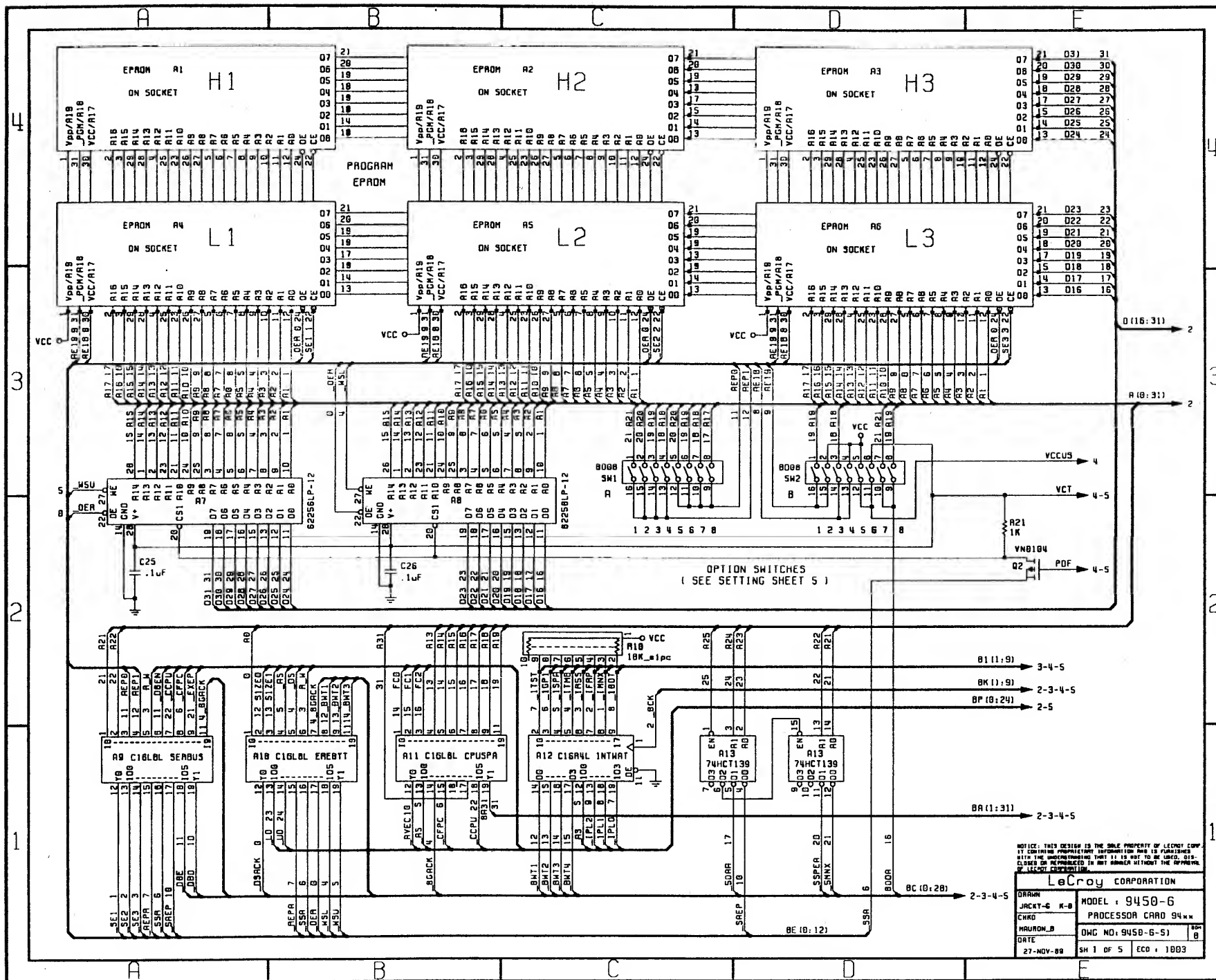
V/DIV\_CH2 V/DIV\_CH1 TIME\_MAGN TIME/DIV PUSH\_1 PUSH\_2 PUSH\_3 PUSH\_4

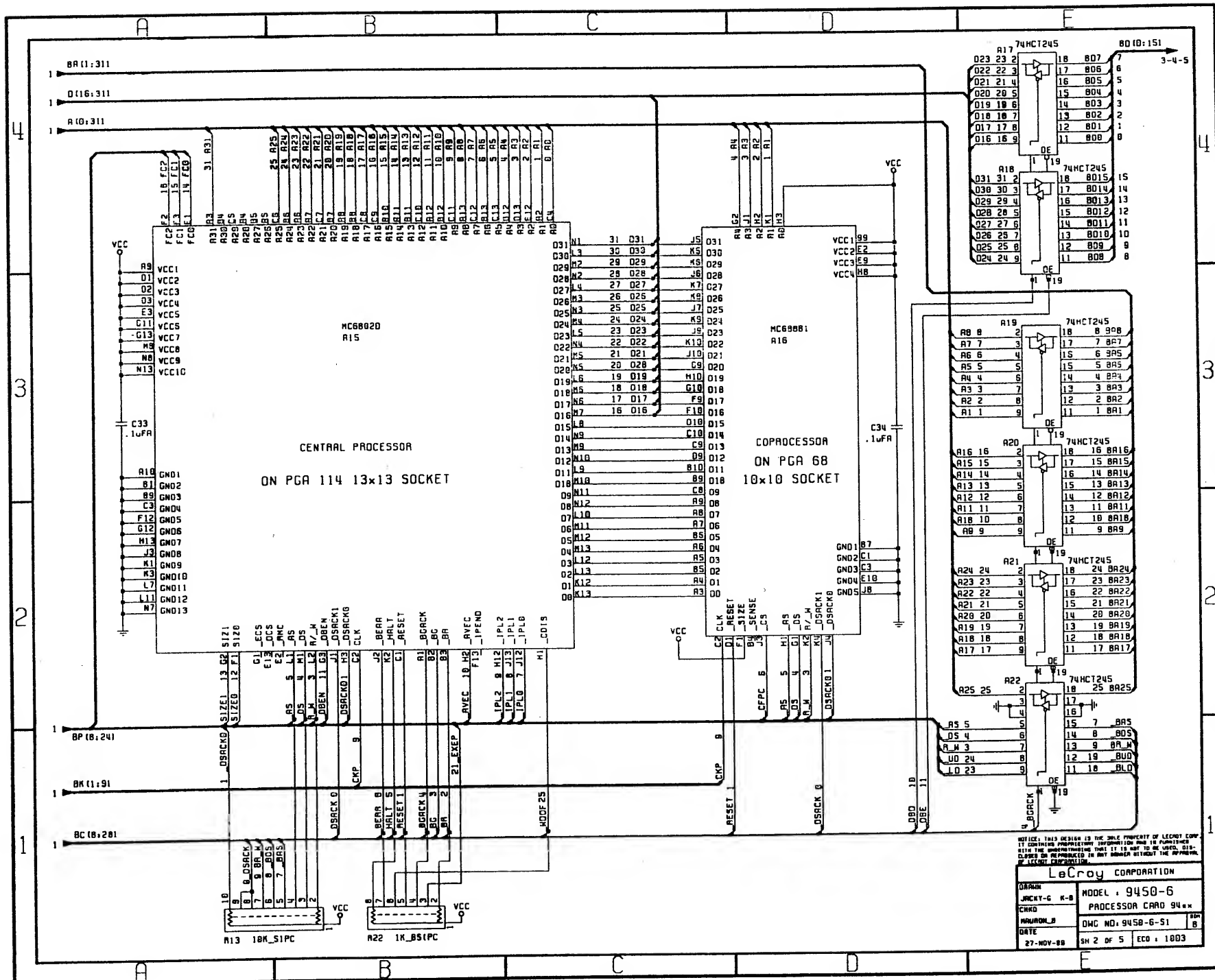


ALL DIODES ARE 6AW62

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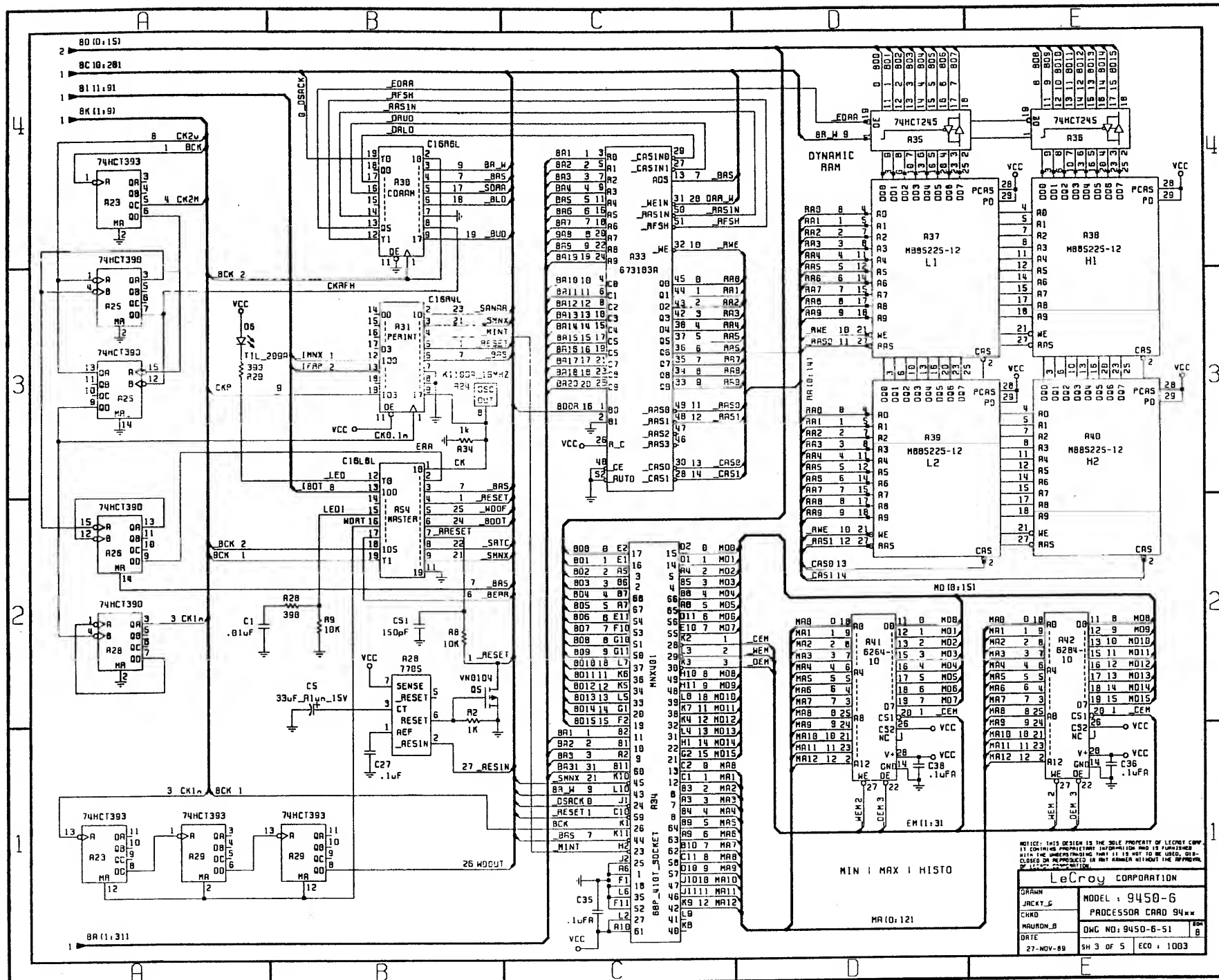
LeCroy CORPORATION	
DESIGN	SCHEMATIC DIAGRAM
JACKY_G	9450-5
CHK	
JACKY_G	QMG NO: 9450-5-S1
DATE	12-SEP-88
SH 2 OF 2	ECN NO 1001



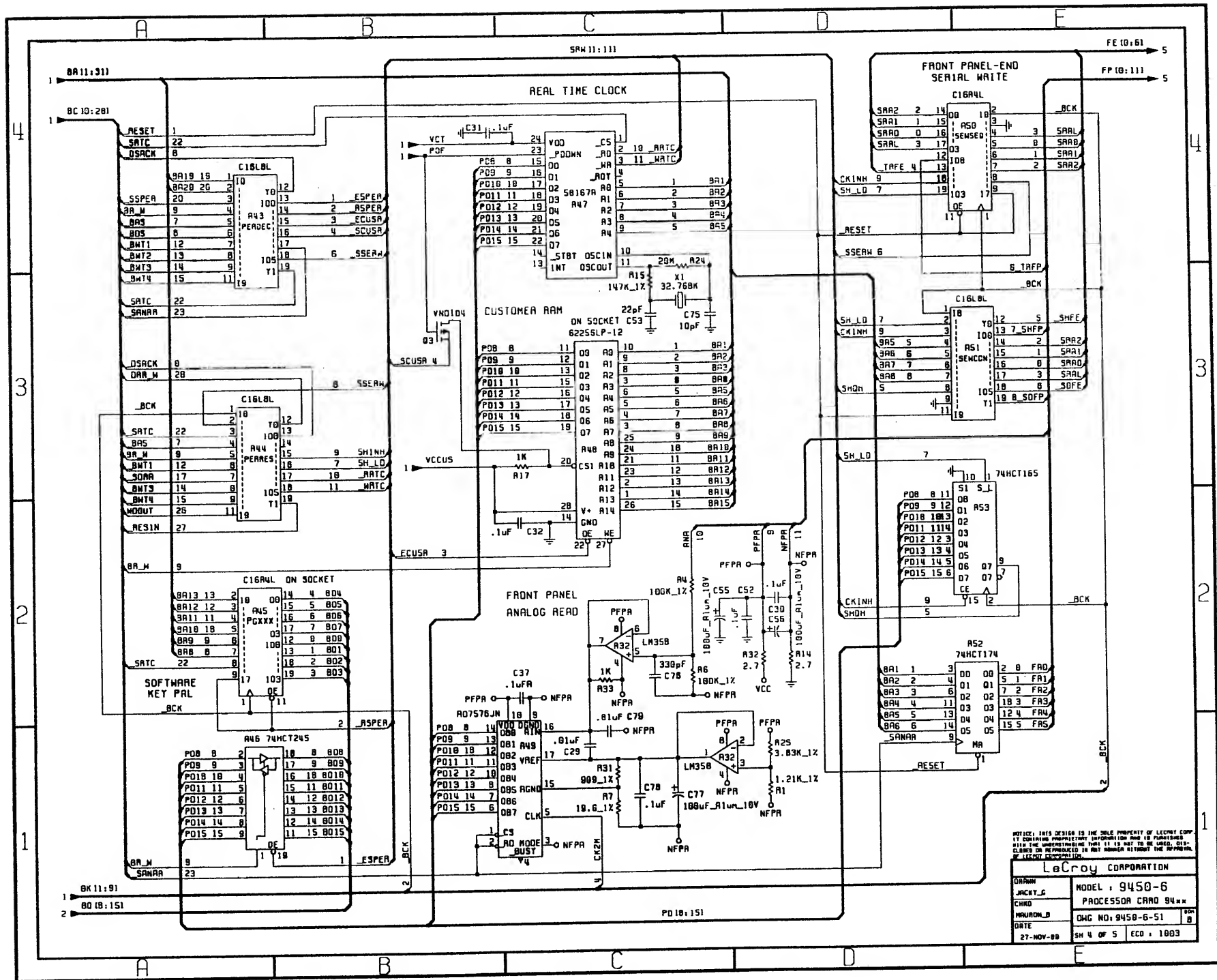


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CLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL  
OF LECROY CORPORATION.

LeCroy CORPORATION	
QUANTITY	MODEL: 9450-6
PACKAGE	PROCESSOR CARD 94x4x
MANUFACTURED	DWG NO: 9450-6-51
DATE	27-NOV-88
SH 2 OF 5	ECO: 1803







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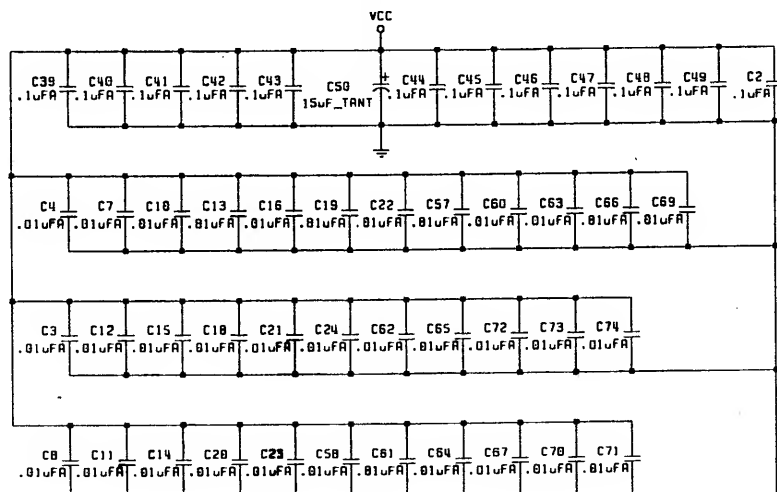
**LeCroy CORPORATION**

DRWING	MODEL : 9450-6
JACKY.G	PROCESSOR CARD 9450-6
CHND	CHG NO: 9450-6-51
HAURON.B	DATE
27-NOV-88	SH 4 OF 5 ECD : 1003

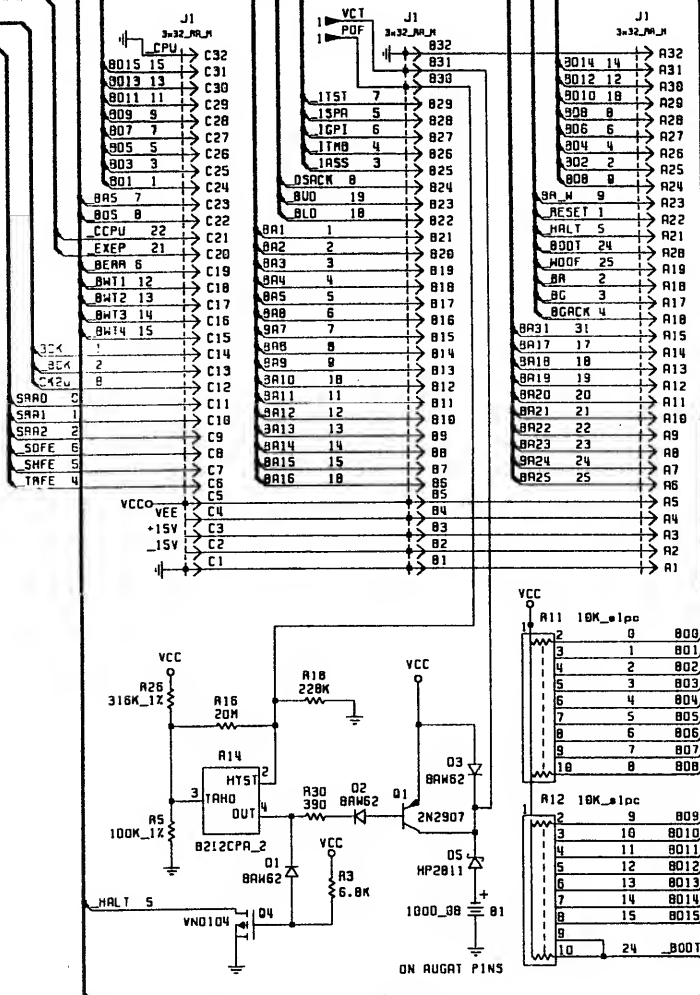
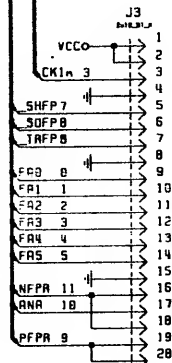
# SWITCH SETTINGS

SWITCH NUMBER	A								B							
EPROM	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
512 Kbit	0	0	0	1	0	0	0	1	0	1	0	1	-	-	-	-
1 Mbit	0	0	1	0	0	0	1	0	0	1	0	1	-	-	-	-
2 Mbit	0	1	0	0	0	1	0	0	0	1	1	0	-	-	-	-
4 Mbit	1	0	0	0	1	0	0	0	1	0	1	0	-	-	-	-
CUST RAM																
static	-	-	-	-	-	-	-	-	-	-	-	0	1	-	-	-
eepron	-	-	-	-	-	-	-	-	-	-	1	0	-	-	-	-
DYN RAM																
256 Kbyte	-	-	-	-	-	-	-	-	-	-	-	0	1	-	-	-
1 Mbyte	-	-	-	-	-	-	-	-	-	-	1	0	-	-	-	-

WARNING! Switches must be set before power-on (short circuit)

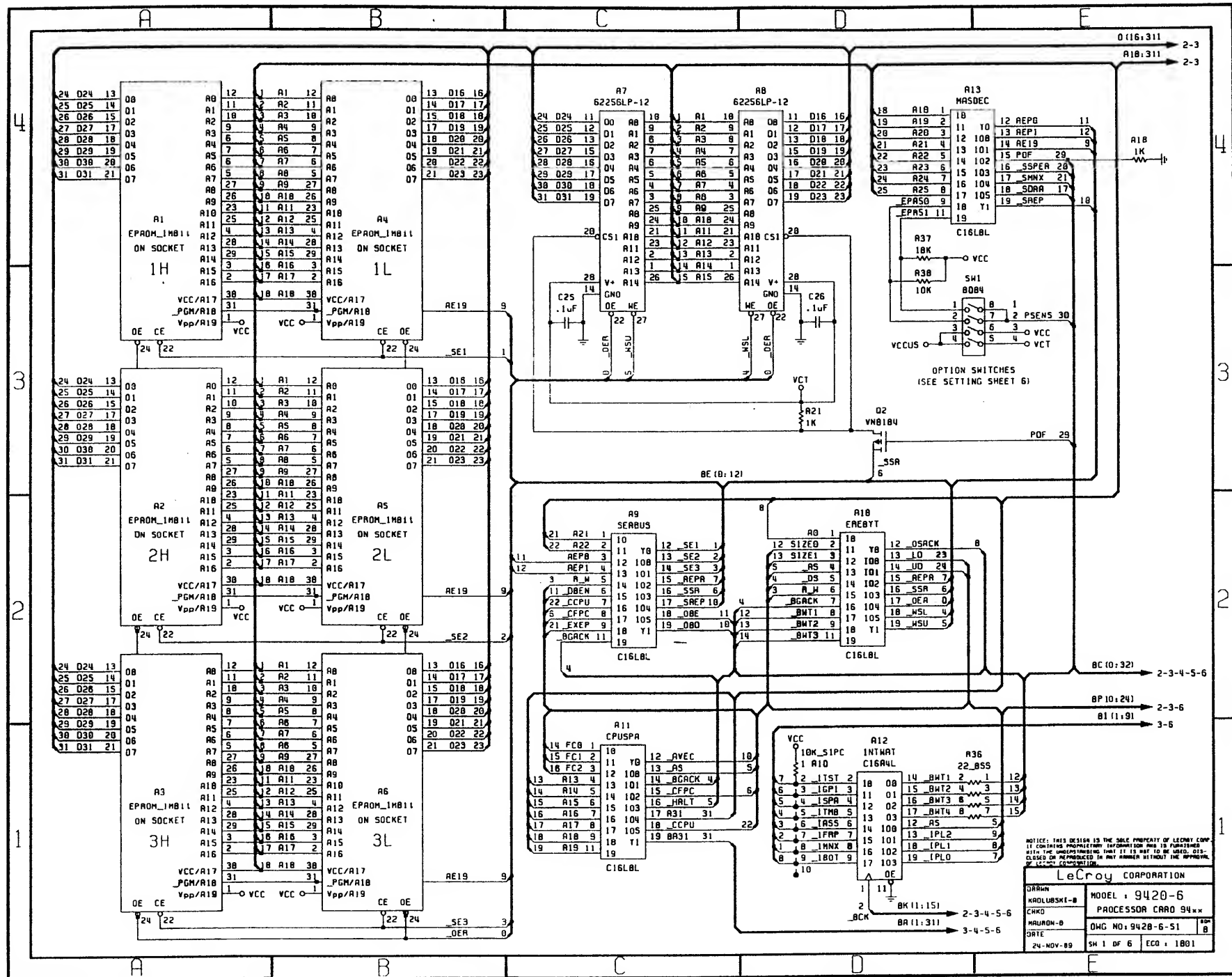


## FRONT PANEL CONNECTOR



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LeCroy CORPORATION	
DRAWN JACKY.G.	MODEL : 9450-6
ENGR MAURON.B	PROCESSOR CARD 94xx
DATE 27-NOV-89	QWG NO: 9450-6-51
27-NOV-89	SH 5 OF 5 ECO : 1803



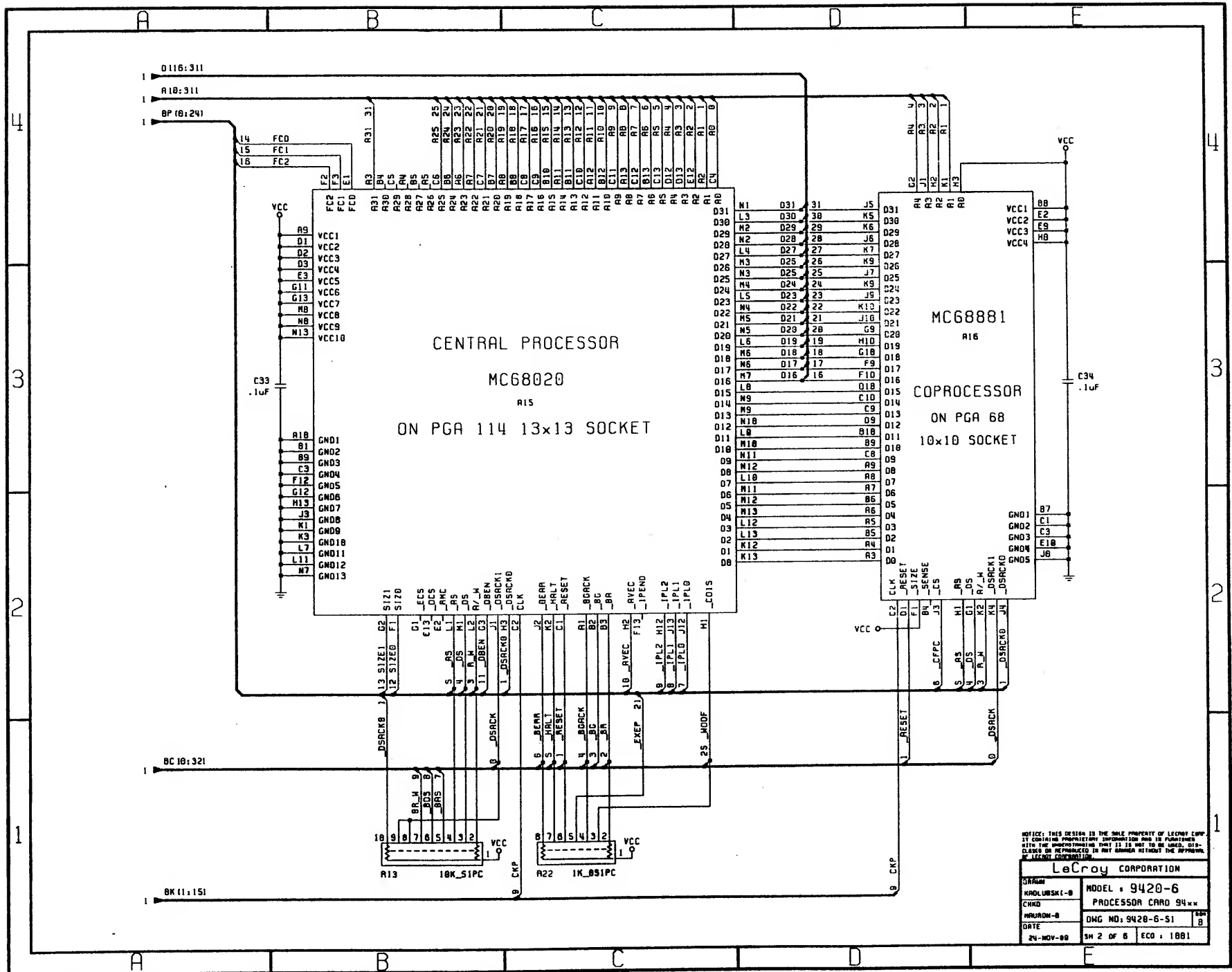
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**LeCroy CORPORATION**

MODEL: 9420-6  
PROCESSOR CARD 94xx

DRAWN: KADLABSKI-B  
CHKD: MALLON-B  
DATE: 24-NOV-89

QWC NO: 9420-6-51  
SW 1 DF 6 ECO: 1801



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LeCroy CORPORATION

DATE: 24-NOV-88

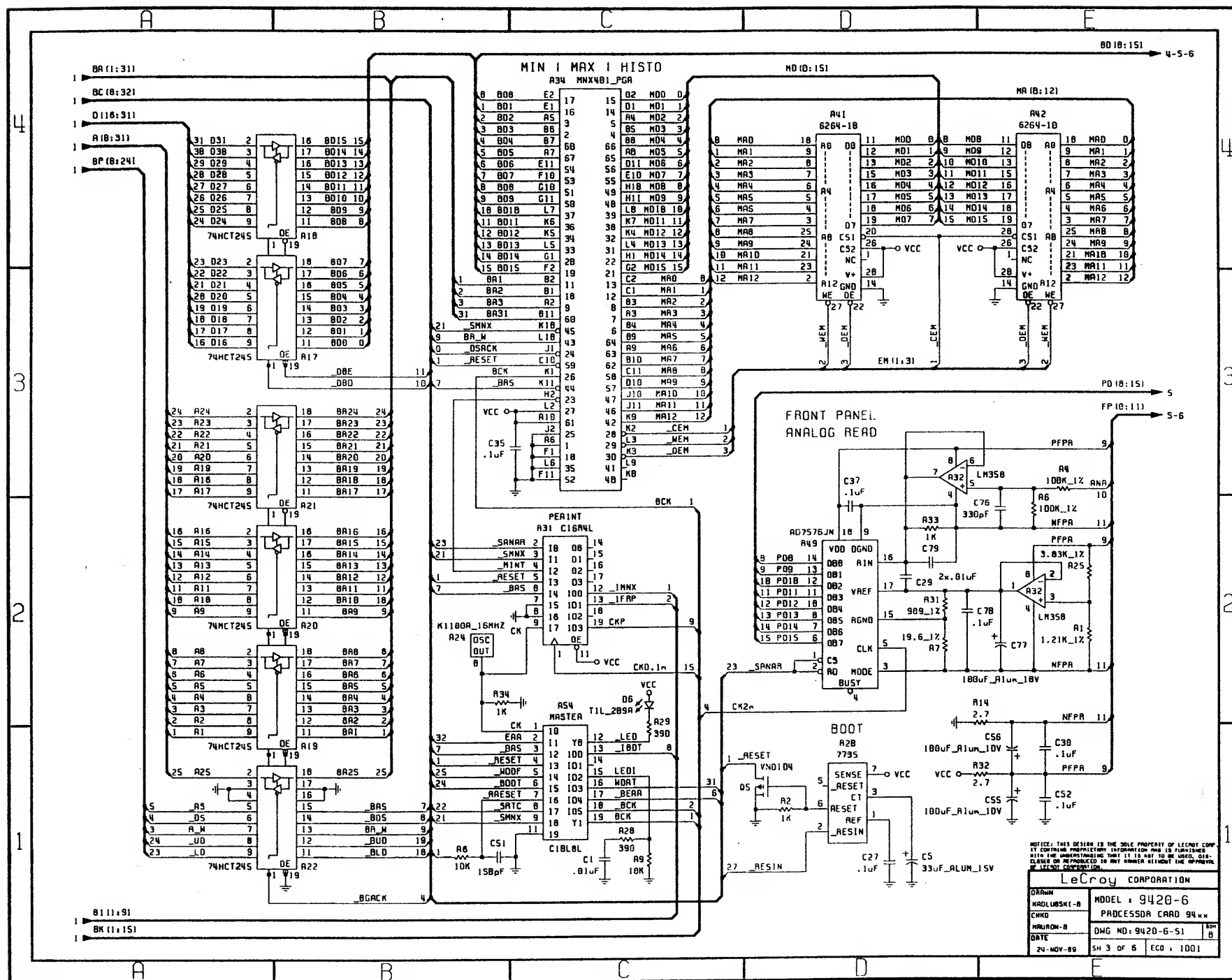
SH 2 OF 8 ECO: 1881

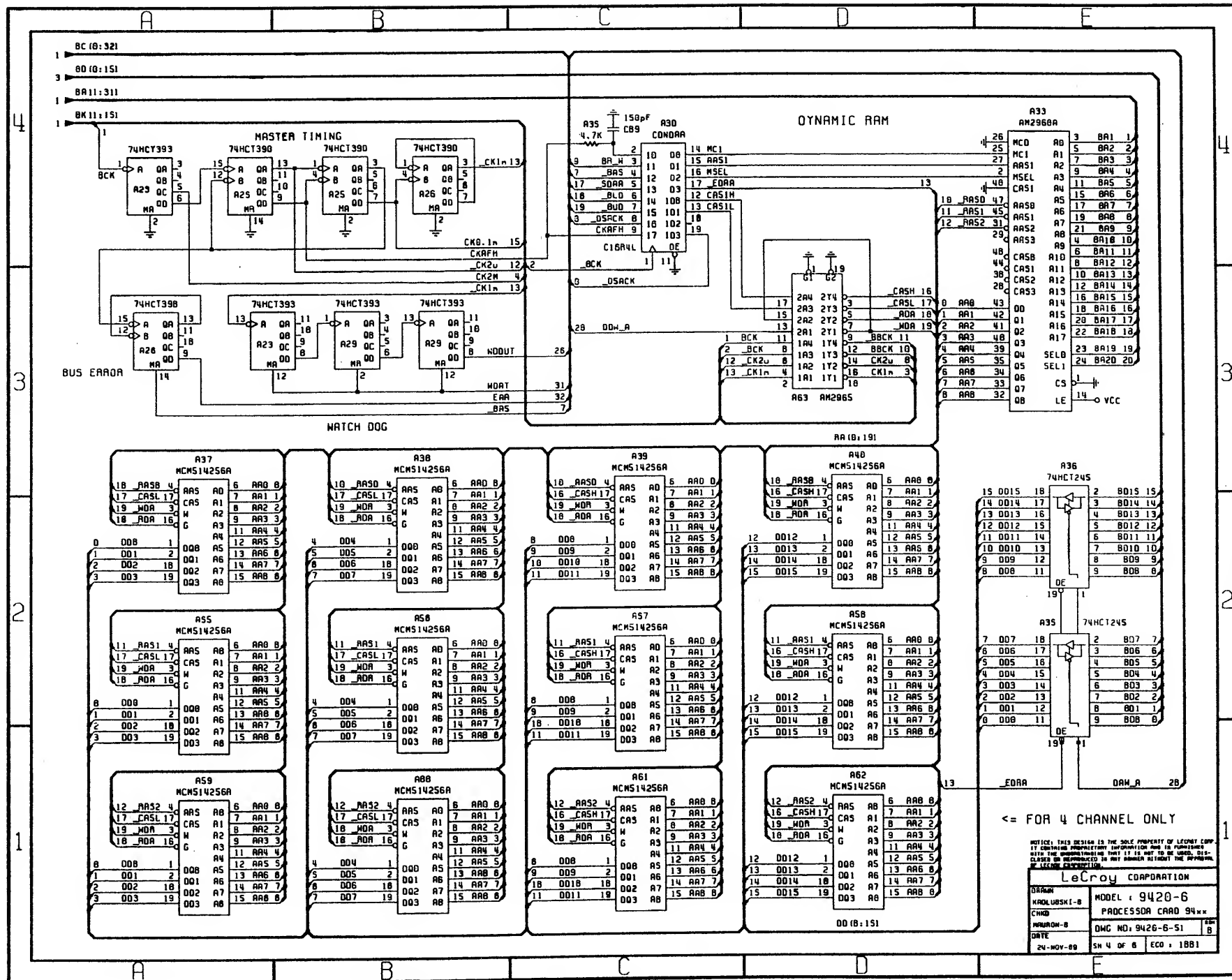
MODEL: 9420-6

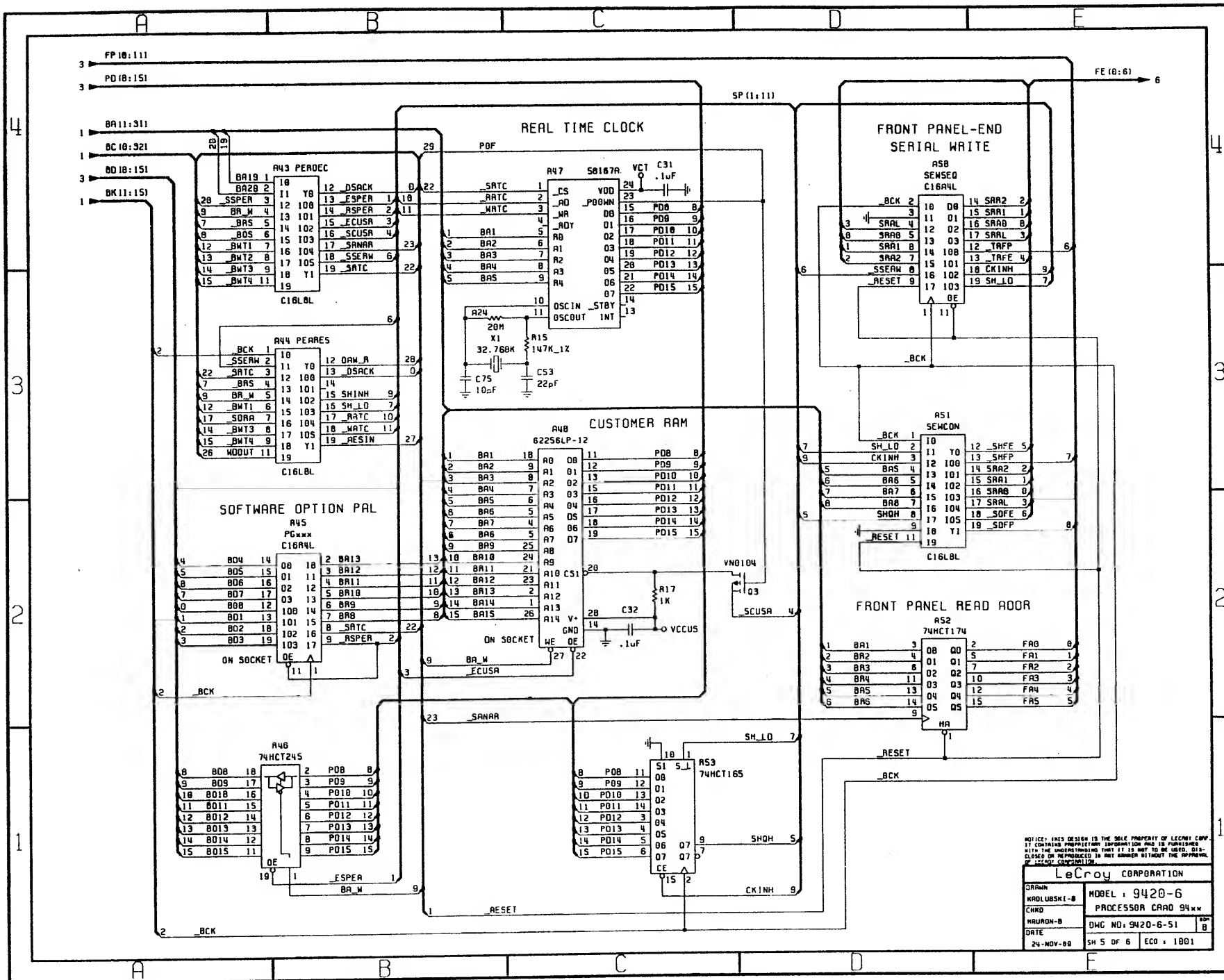
PROCESSOR CARD 94xx

DMG NO: 9420-6-51

8







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LeCroy CORPORATION

DRAWN: KADLUBSKI-B MODEL: 9420-6

CHECKED: MAURON-B PROCESSOR CARD 94xxx

DATE: 24-NOV-88 DWG NO: 9420-6-51

SH 5 OF 6 ECO: 1801

BD18:151  
BC18:321  
BA11:311  
BI11:91  
BP18:241  
BK11:151  
FE10:61  
FP10:111

SWITCH NUMBER :  
1 2 3 4

EPRAM :  
1 Mbit 0 1 --  
2 Mbit 1 0 --  
4 Mbit 1 1 --

CUST RAM :  
STATIC -- 0 1  
EEPROM -- 1 0

WARNING ! Switches must be set  
before power-on (short circuit)

FRONT PANEL  
CONNECTOR

J3  
2x10-ST-M

VCC 0 1  
CK1n 2 3  
7 SHFP 4  
8 SDFP 5  
6 TAFP 6  
0 FAD 7  
1 FA1 8  
2 FA2 9  
3 FA3 10  
4 FA4 11  
5 FAS 12  
11 NFPA 13  
10 ANA 14  
9 PFPA 15  
16 17  
18 19  
20

J1  
3x32-AR-M

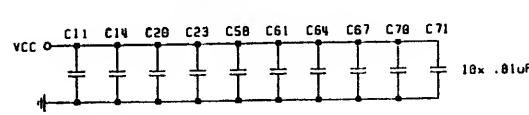
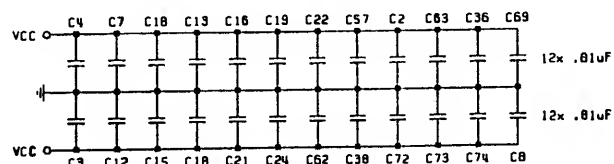
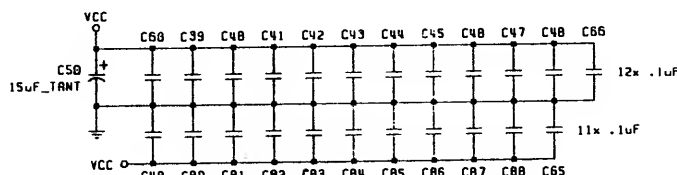
CPU C32  
BD15 C31  
BD13 C30  
BD11 C29  
BD9 C28  
BD7 C27  
BD5 C26  
BD3 C25  
BD1 C24  
BDS C23  
CCPU C22  
EXEP C21  
BEAR C20  
BWT1 C19  
BWT2 C18  
BWT3 C17  
BWT4 C16  
BBS C15  
BBCK C14  
BBCK C13  
CK2u C12  
SAR0 C11  
SAR1 C10  
SAR2 C9  
SDFE C8  
SHFE C7  
TAFE C6  
VCC 0  
VEE C4  
+15V C3  
-15V C2  
-15V C1

J1  
3x32-AR-M

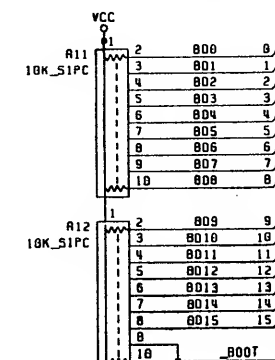
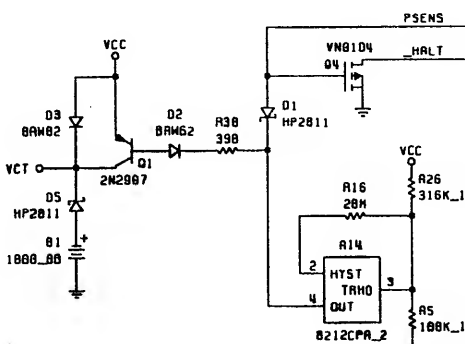
VCT 0  
PDF 29  
1TST 7  
1SPA 5  
1GP1 6  
1TMA 4  
1ASS 3  
DSACK 8  
BUD 19  
BLD 18  
BA1 1  
BA2 2  
BA3 3  
BA4 4  
BA5 5  
BA6 6  
BA7 7  
BA8 8  
BA9 9  
BA10 10  
BA11 11  
BA12 12  
BA13 13  
BA14 14  
BA15 15  
C5  
B5

J1  
3x32-AR-M

BD14 A32  
BD12 A31  
BD10 A30  
BD8 A29  
BD6 A28  
BD4 A27  
BD2 A26  
BD0 A25  
BR M A24  
RESET A23  
HALT A22  
BOOT A21  
HDDF A20  
BA A19  
BG A18  
BGACK A17  
BA31 A16  
BA17 A15  
BA18 A14  
BA19 A13  
BA20 A12  
BA21 A11  
BA22 A10  
BA23 A9  
BA24 A8  
BA25 A7  
A6  
A5  
A4  
A3  
A2  
A1



POWER SUPPLY MONITOR



ALL ICs WITH NO POWER SUPPLY SHOWN ON SCHEMATIC HAVE STANDART TTL SUPPLIES .

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LeCroy CORPORATION

DATE: 24-NOV-88

MODEL: 9420-6

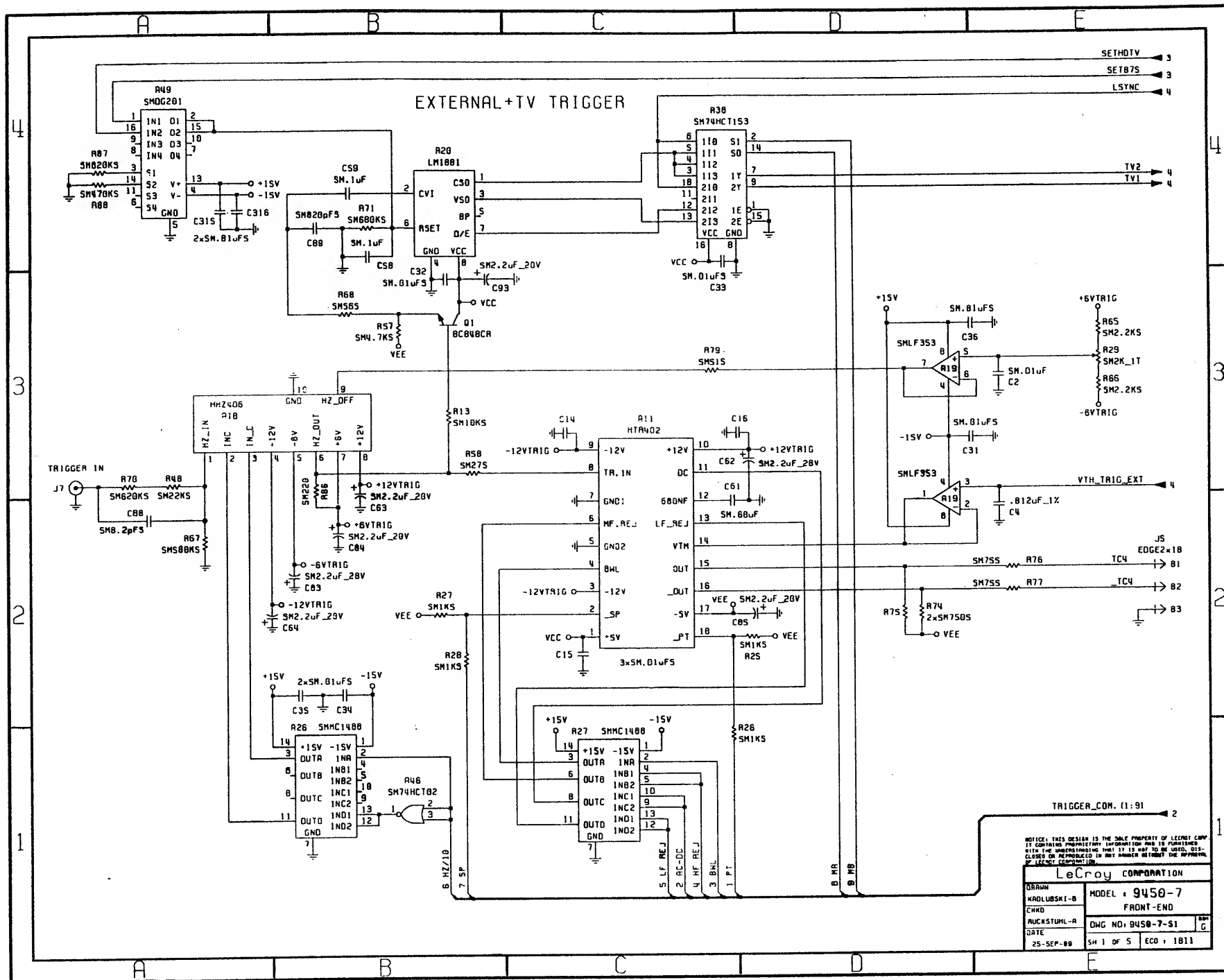
PROCESSOR CARD 94xx

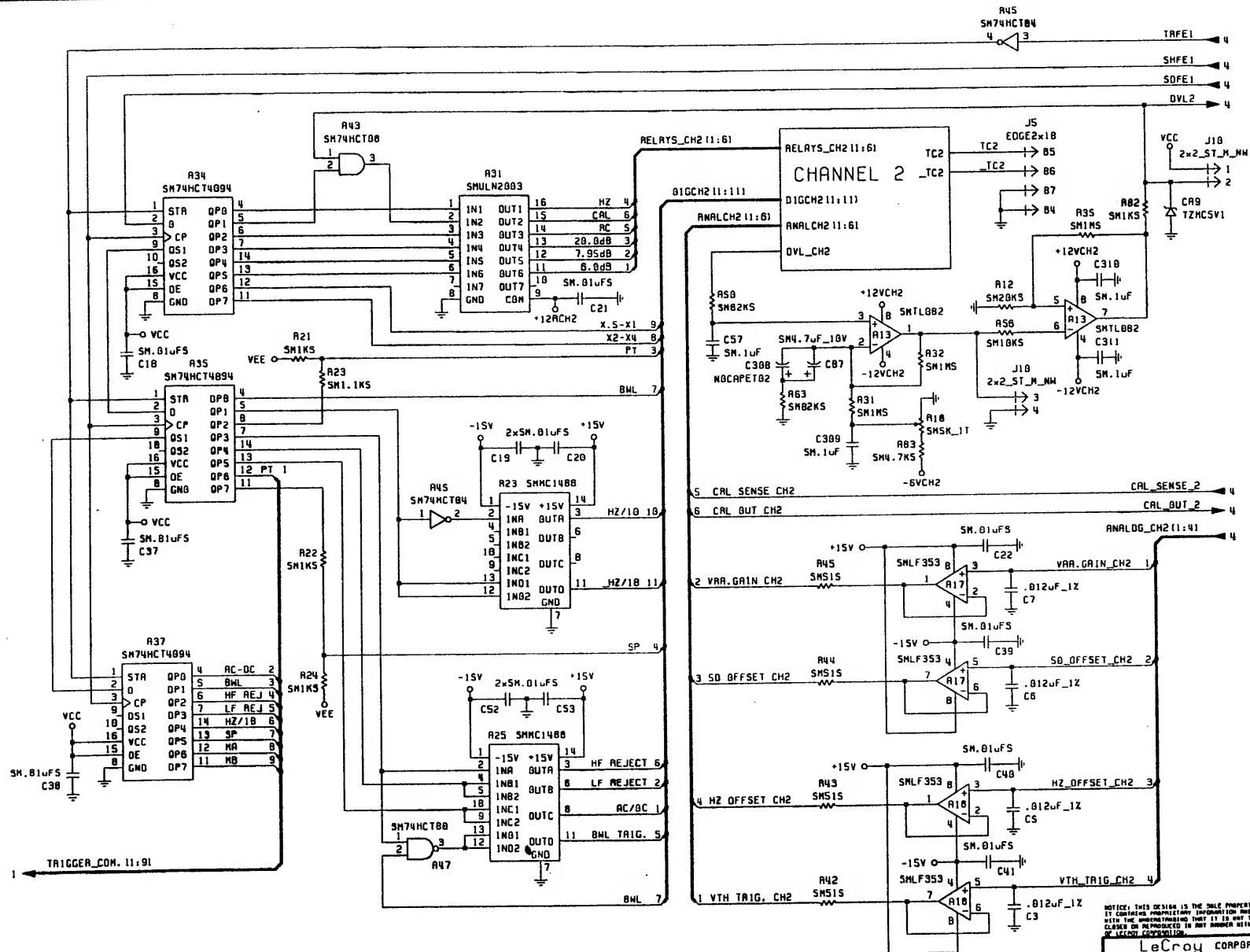
DWG NO: 9420-6-S1

SH 8 OF 8

ECO: 1001

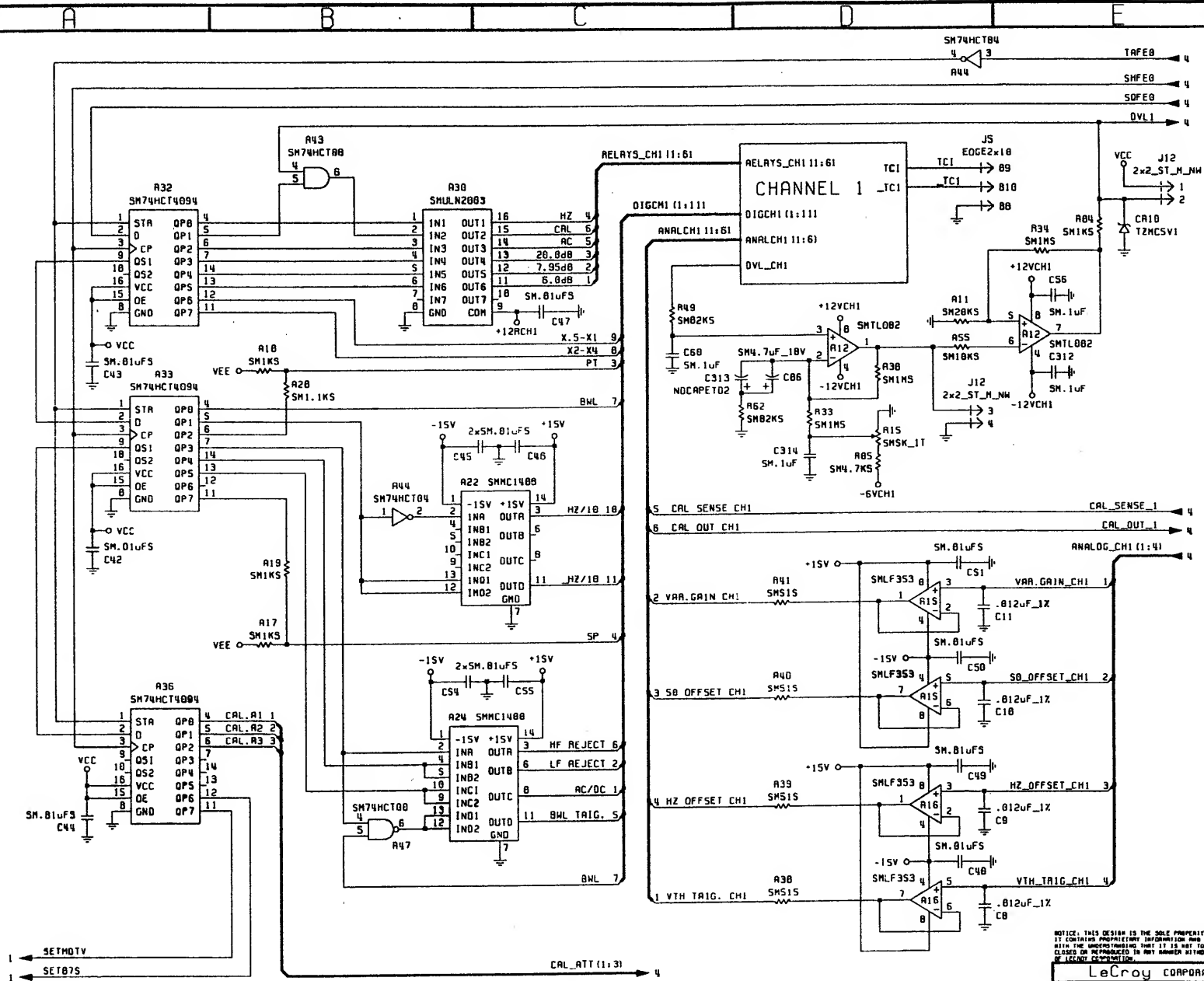






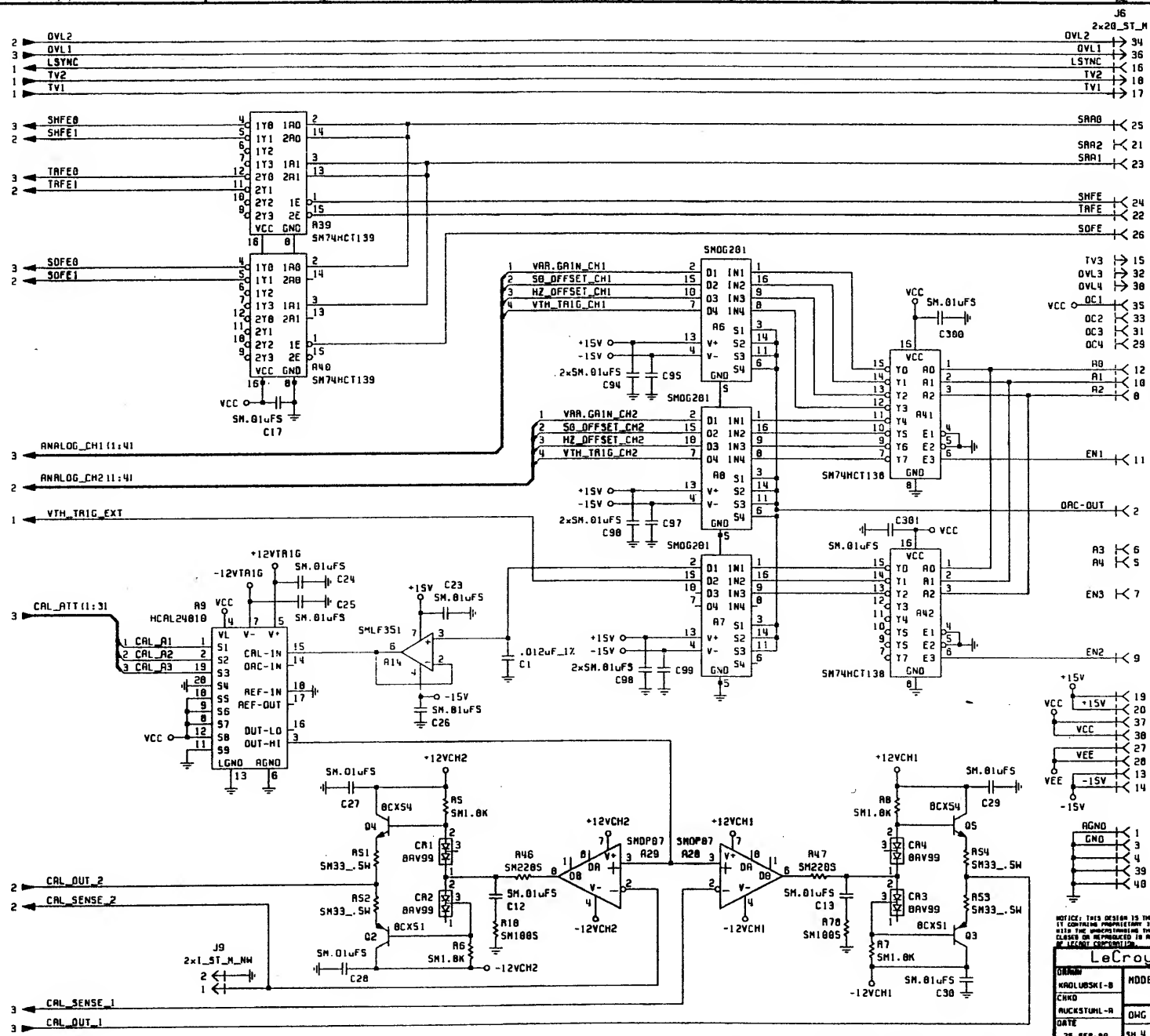
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LeCroy CORPORATION	
DRAWN KROLOUSKI-B CHECKED PUCKSTUNL-A DATE 25-SEP-88	MODEL - 9450-7 FRONT-ENG DWG NO: 9450-7-51 SH 2 OF 5 ECO: 1811



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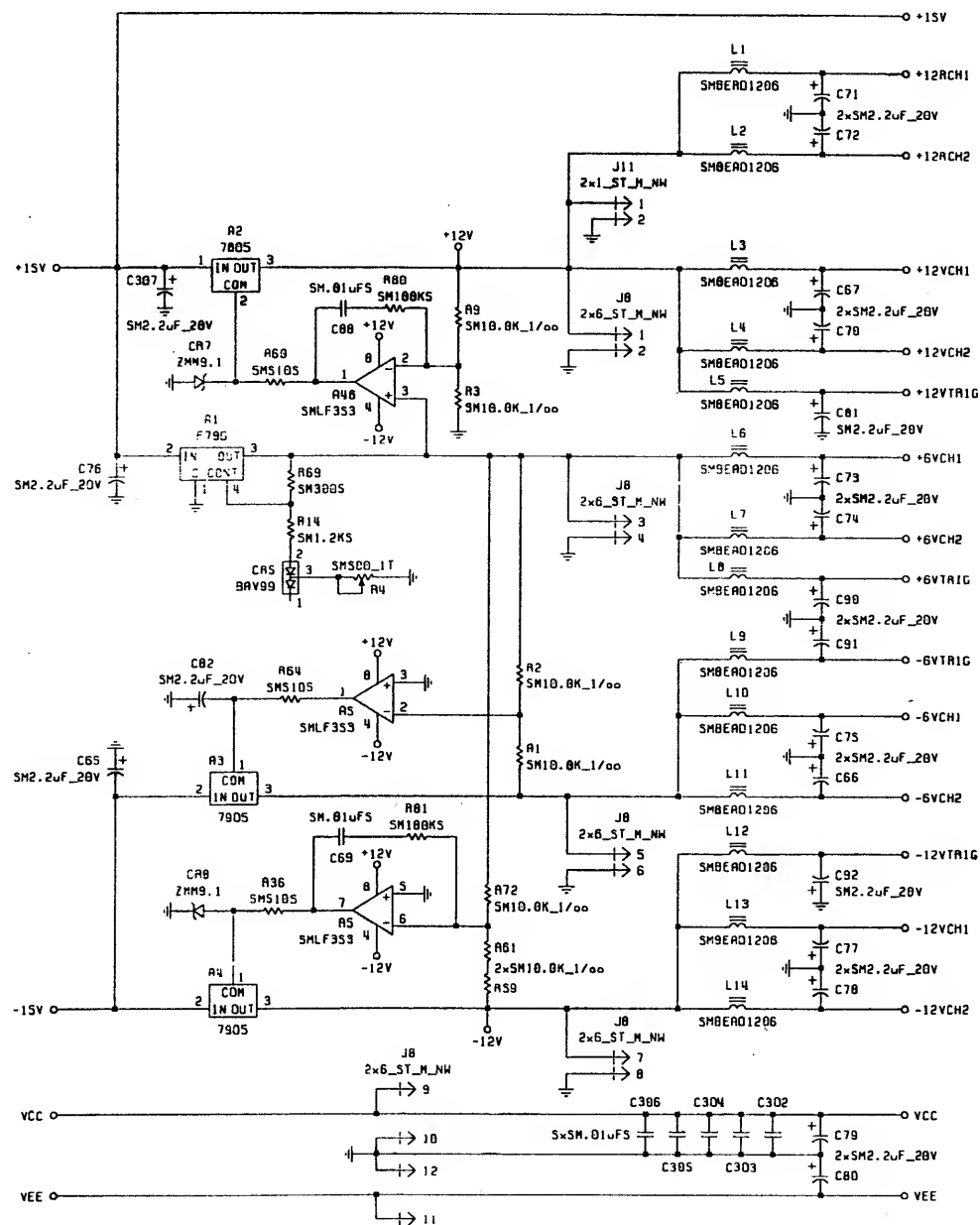
LeCroy CORPORATION	
DRW	MODEL : 9450-7
KADLUSKI-B	FRONT-END
CHKD	DMG NO: 9450-7-51
AUCKSTUHL-A	DATE
25-SEP-88	SH 3 OF 5 ECO : 1011



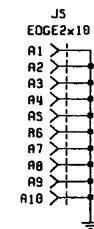
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**LeCroy CORPORATION**

DESIGN	MODEL : 9450-7
DRW	FRONT-END
CHKD	QMG NO: 9450-7-S1
DATE	25-SEP-89
SH 4 OF 5	ECO : 1811



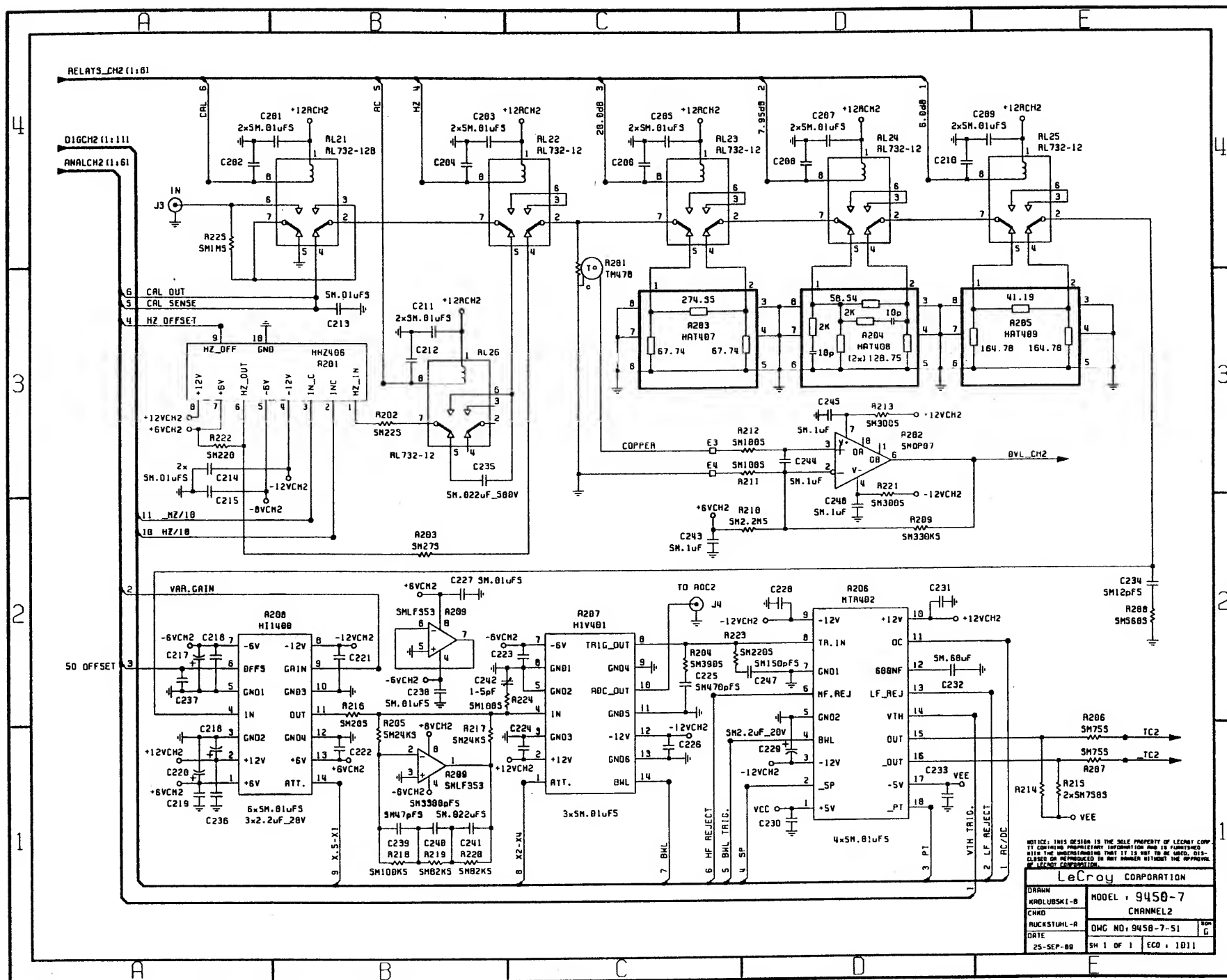
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 +12ACH2    +12ACH2  
 +12VCH1    +12VCH1  
 +12VCH2    +12VCH2  
 +6VCH1    +6VCH1  
 +6VCH2    +6VCH2  
 U7    -6VCH1  
 U8    -6VCH2  
 U9    -12VCH1  
 U10    -12VCH2  
 VCC1    VCC  
 VEE1    VEE  
 VCC2    VCC  
 VEE2    VEE  
 GND10  
 GND11  
 GND12  
 GND20  
 GND21  
 GND22

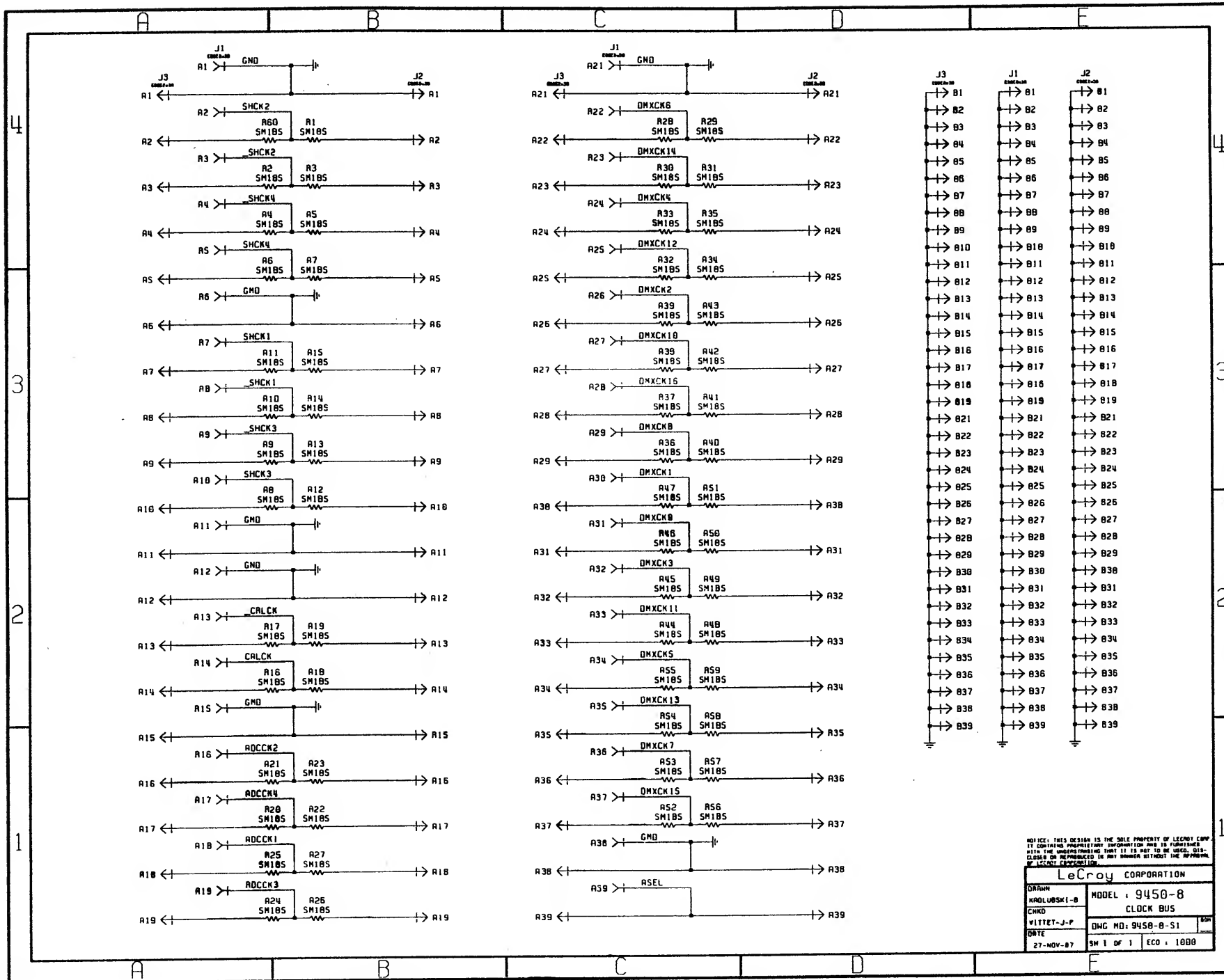


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LeCroy CORPORATION	
DRAWN KROLOUSKI-B CHECKED APPROVED DATE 25-SEP-88	MODEL : 9450-7 FRONT-END DWG NO: 9450-7-51 SH 5 OF 5 ECO : 1011









## Parts List

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----			
F9450-1		COMPLETED BOARD F9450-1	A 1.00
102484471		CAP CERA DISC 100V 470 PF	1.00
103307103		CAP CERA MOND 50V .01 UF	28.00
103427104		CAP CERA MOND 100V .1 UF	2.00
142214156		CAP TANT DIP CASE 15 UF	2.00
142714685		CAP TANT DIP CASE 6.8UF	2.00
146634106		CAP MINI ALUM 20% 10 UF	2.00
147436033		CAP ALUM METAL CAN 33 UF	4.00
161225101		RES COMP 1/8W 5% 100 OHMS	1.00
161225103		RES COMP 1/8W 5% 10 K	3.00
161225274		RES CARBON FILM 270 K	1.00
161225302		RES COMP 1/8W 5% 3 K	2.00
161225395		RES CARBON FILM 3.9 MEG	1.00
161225471		RES COMP 1/8W 5% 470 OHMS	1.00
181447104		RES VARI CERMET 100 K	2.00
190042103		RESISTOR NETWORK 10 K	1.00
190042104		RESISTOR NETWORK 100K	2.00
190832102		RES NETWORK 1 K	1.00
190832103		RESISTOR NETWORK 10K	1.00
190832471		RESISTOR NETWORK 470 OHMS	2.00
200331074		IC DUAL FLOP 74HCT74	1.00
200340173		IC D-TYP FLOP HCT173	2.00
200373374		IC D-TYP FLOP 74HCT374	2.00
200440040		IC12-ST BIN COUNT HCT4040	1.00
200440102		IC COWN COUNT. 74HCT40102	1.00
205277202		FIFO 1024X9 BITS	1.00
205751116		IC 8-IN AND-OR ARRAY 16R6	1.00
205752164		IC AND-OR GATE ARRAY 16R4	2.00
205752168		IC AND-OR GATE ARRAY 16L8	3.00
207171541		IC BUFFER/LINE DRI.HCT541	5.00
207197210		IC BUS INTERF CONTR 7210	1.00
207280703		IC 16-BIT DAC 703	1.00
207440232		IC XMTR/RCVR MAX 232	1.00
207470160		IC OCTAL BUS XCVR 75160A	1.00
207470161		IC DCTL BUS XCEIR 75161A	1.00
207472245		IC BUS TRANSCVR HCT245	2.00
207552661		IC INTERFACE 2661A	1.00
230020062		DIODE SWITCHING BAW62	16.00
253010835		DIODE HOT CARRIER HP2835	3.00
309040005		CRYSTAL OSCIL. 4.9152MHZ	1.00
400331020		SOCKET IC ST DIP-20	1.00
400412068		IC SOCKET GRID TYP 68-PIN	1.00
403950002		POLARIZING KEY	2.00
412022022		SWITCH ROTARY BCD-1248	2.00
416132008		SWITCH PUSHBUT (MOM) SPDT	1.00
453520024		RTANGLE PCB CONN. FEM.24	1.00
454110010		HDR SOLD TAIL/MALE PIN 10	1.00
454211040		HDR SOLD TAIL TO MALE 40	1.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789	-----	-----	-----
	454320096	HDR DIP SOLD TO FEM 96	6.00
	454611009	HDR SOLD TAIL/MALE 9	1.00
	454611025	HDR SOLD TAIL/MALE 25	1.00
	455980001	MOUNT. HDW FOR CONN SHELL	2.00
	530040006	BUZZER 85DB 4 TO 7V	1.00
	550130108	SCREW CYL HD M3X8	4.00
	550130110	SCREW CYL HD M3X10	2.00
	551430100	FLAT WASHER M3	6.00
	552130101	NUT HEX M3	6.00
	585252236	RIVET HOLLOW 2.5X6MM	12.00
	719450103	PC BD PREASS'Y 9450-1	1.00
	MCL404	IC MEM GATE ARRAY MCL404	1.00
F9450-2		COMPLETED BOARD F9450-2	F 1.00
	102412018	CAP CERA DISC 100V 1.8 PF	1.00
	102412220	CAP CERA DISC 100V 22 PF	1.00
	102412470	CAP CERA DISC 100V 47 PF	5.00
	102412560	CAP CERA DISC 100V 56 PF	1.00
	102484821	CAP CERA DISC 100V 820 PF	1.00
	102940502	CAP CERA DISC 1KV .005 UF	4.00
	103307103	CAP CERA MONO 50V .01 UF	57.00
	103327102	CAP CERA MONO 50V .001 UF	2.00
	103327224	CAP CERA MONO 50V .22UF	2.00
	103427104	CAP CERA MONO 100V .1 UF	4.00
	103437334	CAP CERA MONO 100V .33 UF	8.00
	124171623	CAP POLYSTYR 1% .062 UF	2.00
	142714685	CAP TANT DIP CASE 6.8UF	1.00
	146544471	CAP MINI ALUM 20% 470UF	4.00
	146634106	CAP MINI ALUM 20% 10 UF	18.00
	146754470	CAP MINI ALUM 20% 47 UF	1.00
	147634102	CAP MINI ALUM 20% 1000 UF	1.00
	161335100	RES COMP 1/4W 5% 10 OHMS	1.00
	161335101	RES COMP 1/4W 5% 100 OHMS	4.00
	161335102	RES COMP 1/4W 5% 1 K	16.00
	161335103	RES COMP 1/4W 5% 10 K	12.00
	161335104	RES COMP 1/4W 5% 100 K	8.00
	161335105	RES COMP 1/4W 5% 1 MEG	2.00
	161335122	RES COMP 1/4W 5% 1.2 K	5.00
	161335132	RES COMP 1/4W 5% 1.3 K	1.00
	161335161	RES COMP 1/4W 5% 160 OHMS	1.00
	161335202	RES COMP 1/4W 5% 2 K	6.00
	161335203	RES COMP 1/4W 5% 20 K	2.00
	161335204	RES COMP 1/4W 5% 200 K	1.00
	161335221	RES COMP 1/4W 5% 220 OHMS	8.00
	161335223	RES COMP 1/4W 5% 22 K	1.00
	161335241	RES COMP 1/4W 5% 240 OHMS	8.00
	161335242	RES COMP 1/4W 5% 2.4 K	4.00
	161335271	RES COMP 1/4W 5% 270 OHMS	2.00
	161335272	RES COMP 1/4W 5% 2.7 K	2.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789	-----	-----	-----
161335273		RES COMP 1/4W 5% 27 K	1.00
161335302		RES COMP 1/4W 5% 3 K	7.00
161335331		RES COMP 1/4W 5% 330 OHMS	1.00
161335333		RES COMP 1/4W 5% 33 K	2.00
161335362		RES COMP 1/4W 5% 3.6 K	3.00
161335394		RES COMP 1/4W 5% 390 K	4.00
161335471		RES COMP 1/4W 5% 470 OHMS	14.00
161335472		RES COMP 1/4W 5% 4.7 K	2.00
161335473		RES COMP 1/4W 5% 47 K	1.00
161335510		RES COMP 1/4W 5% 51 OHMS	4.00
161335511		RES COMP 1/4W 5% 510 OHMS	1.00
161335565		RES COMP 1/4W 5% 5.6 MEG	2.00
161335621		RES COMP 1/4W 5% 620 OHMS	2.00
161335622		RES COMP 1/4W 5% 6.2 K	2.00
161335623		RES COMP 1/4W 5% 62 K	1.00
161335681		RES COMP 1/4W 5% 680 OHMS	1.00
161335682		RES COMP 1/4W 5% 6.8 K	2.00
161335752		RES COMP 1/4W 5% 7.5 K	7.00
161335753		RES COMP 1/4W 5% 75 K	3.00
161335821		RES COMP 1/4W 5% 820 OHMS	2.00
161335912		RES COMP 1/4W 5% 9.1 K	1.00
161445102		RES COMP 1/2W 5% 1K	1.00
161445560		RES CARBON FILM 56 OHMS	1.00
165375824		RES METAL FILM HV 820 K	1.00
168031022		RES METAL FILM 2.2 OHMS	26.00
168035125		RES METAL FILM HV 1.2 MEG	1.00
168045336		RES HV 33M	1.00
168531365		RES PREC RN55D 511 OHMS	4.00
168531385		RES PREC RN55D 825 OHMS	2.00
168531401		RES PREC RN55D 1.21 K	7.00
168531445		RES PREC RN55D 3.48K	1.00
168531447		RES PREC RN55D 3.65 K	1.00
168531453		RES PREC RN55D 4.22 K	1.00
168531481		RES PREC RN55D 8.25 K	2.00
168531495		RES PREC RN55D 11.5K	3.00
168531541		RES PREC RN55D 34.8 K	1.00
172137022		RES WIREWOUND .22 OHMS	1.00
180487103		RES VARI CERMET 10K	2.00
180487202		RES VARI CERMET 2K	1.00
180487205		RES VARI CERMET 2 MEG	2.00
180487501		RES VARI CERMET 500 OHMS	2.00
180487502		RES VARI CERMET 5K	5.00
190042222		RESISTOR NETWORK 2.2 K	5.00
190842222		RESISTOR NETWORK 2.2 K	1.00
200440040		IC12-ST BIN COUNT HCT4040	1.00
205271256		HITACHI HM62256LP-12	2.00
205370256		IC UV E-PROM 27256G-25	2.00
205752164		IC AND-OR GATE ARRAY 16R4	3.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: E

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789	-----	-----	-----
205752168		IC AND-OR GATE ARRAY 16L8	1.00
207174244		IC OCTAL BUFFER HCT244	2.00
207270312		IC 12-BIT C/A CONV. DAC312	2.00
207472245		IC BUS TRANSCLR HCT245	2.00
208011005		IC VOLT FOLLOWER LM310N	2.00
208031010		IC QUAD DIFF COMP LM339N	1.00
208041001		IC 8-BIT DAC MONODAC-08E0	3.00
208041524		IC PULSE WIDTH MODUL 3524	1.00
208110353		IC DUAL OP AMP LF353N	2.00
208116365		IC OP AMP LM6365	2.00
208130347		IC QUAD JFET OP AMP LF347	1.00
208590336		IC VOLT REFERENCE LM336	2.00
230110005		DIODE SWITCHING 1N4448	14.00
230150045		DIODE PICOAMPERE BAV 45	2.00
232990641		DIODE ARRAY (HV CASCADE)	1.00
235040060		DIODE RECTIFIER LM60	1.00
235820030		DIODE RECTIFIER EGP30D	1.00
235930816		DIODE RECTIFIER 1A MR816	1.00
240225720		DIODE ZENER 18V 1N720A	2.00
240415754		DIODE ZENER 6.8V 1N754A	2.00
240423958		DIODE ZENER 7.5V 1N958B	2.00
240425751		DIODE ZENER 5.1V 1N751A	1.00
240425752		DIODE ZENER 5.6V 1N752A	1.00
240425758		DIODE ZENER 10V 1N758A	1.00
240513977		DIODE ZENER 47V 1N977B	1.00
253010835		DIODE HOT CARRIER HP2835	15.00
270170001		TRANSISTOR NPN 2N5770	17.00
270170002		TRANSISTOR NPN 2N5962	21.00
275110001		TRANSISTOR PNP 2N2907A	4.00
275170001		TRANSISTOR PNP 2N5087	5.00
275170002		TRANSISTOR PNP 2N5771	16.00
280180001		TRANSISTOR FET "N" U1897	3.00
280190513		TRANSISTOR FET "N" IRF513	2.00
280190642		TRANSISTOR FET "N" IRF642	1.00
280190830		TRANSISTOR FET "N" IRF830	1.00
281170001		TRANSISTOR FET "P" 2N5462	4.00
281190523		TRANSISTOR FET "P" 9523	2.00
301016103		INDUCTOR MOLDED 10 UH	4.00
302380480		FILTER CHOKE 2 AMP 48 UH	1.00
377051004		LABEL "DANGER HI VOLTAGE"	1.00
400360028		SOCKET IC ST DIP-28	2.00
400410121		IC SOCKET GRID TYP 121PIN	1.00
429220001		SWITCH THERMAL 1A N.O.	1.00
440290001		TRANSFORMER HV SWITCHING	1.00
454110003		HDR SOLD TAIL/MALE PIN 3	2.00
454111008		HDR SOLD TAIL/MALE PIN 8	1.00
454121003		BLOC FOR SOCKETS 3-PIN	1.00
454311003		HDR DIP SOLDER TO MALE 3	2.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789	-----	-----	-----
	454610096	HDR DIP SOLD TO MALE 96	1.00
	454711026	HDR DBL ROW RT ANGL 26	1.00
	454902001	KEYING PLUG (SNAP IN) BLK	3.00
	485011001	GROMMET 10MM OD 5MM ID	1.00
	500460005	MOUNTING KIT FOR TO-220	6.00
	550430105	SCREW CYL HD PHIL M3X5	7.00
	550440106	SCREW CYL HD PHIL M4X6	2.00
	550440108	SCREW CYL HD PHIL M4X8	2.00
	551430300	WASHER SHAKEPROOF M3	11.00
	551440300	WASHER SHAKEPROOF M4	4.00
	500110001	TRANSIPAD "SMALL"	2.00
	560440004	SCREW PHILIPS 4-40X1/4	6.00
	585252354	RIVET HOLLOW 2.5X9MM	2.00
	709400231	HV MULTIPLIER SUPPORT	1.00
	709450201	HV UPPER COVER	1.00
	709450211	HV LOWER COVER	1.00
	709450221	FET SUPPORT	1.00
	709450231	SPACER HEX M3X6MM	3.00
	719450203	PC BD PREASS'Y 9450-2	H 1.00
	MDS403	DISPLAY PROCESSOR MDS403	1.00
	161335332	RES COMP 1/4W 5% 3.3 K	6.00
	161335512	RES COMP 1/4W 5% 5.1 K	7.00
	270110003	TRANSISTOR NPN PN2222A	3.00
	161335560	RES COMP 1/4W 5% 56 OHMS	4.00
	102412101	CAP CERA DISC 100V 100PF	2.00
	102412120	CAP CERA DISC 100V 12 PF	6.00
	550430106	SCREW CYL HD PHIL M3X6	4.00
	554435401	RIVET "RIVSCREW" M 3.5	2.00
	F9450-3A	COMPLETED BOARD F9450-3A	E 2.00
	SM158102025	CAP VARIABLE 5 - 25 PF	2.00
	161445151	RES CARBON FILM 150 OHMS	16.00
	SM185248103	RES VARI CERMET 10K	8.00
	SM185457500	RES VARI CERMET 50 OHMS	8.00
	190642151	RESISTOR NETWORK 150	4.00
	190642221	RESISTOR NETWORK 220 OHMS	4.00
	190642471	RESISTOR NETWORK 470 OHMS	12.00
	190642821	RESISTOR NETWORK 820 OHMS	16.00
	SM200170032	IC 2-IN OR GATE 74F32	2.00
	SM200170138	IC DECODER 74ALS138	2.00
	SM200172004	IC HEX INVERTER 74F04	2.00
	SM200172008	IC AND GATE 74F08	2.00
	SM205220168	IC 16K SRAM 6168SD-25	64.00
	205271256	HITACHI HM62256LP-12	8.00
	205752168	IC AND-OR GATE ARRAY 16L8	6.00
	SM207162965	IC MEMORY DRIVER 2965	4.00
	SM207179244	IC BUF/LINE DRIV HCT244	12.00
	207200200	IC 8-BIT FLASH ADC 77200	8.00
	SM207244110	IC 8-BIT DAC BT110	4.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----			
SM207360125		IC TRANSLATO MC10125	20.00
SM207460116		IC LINE RECEIVER 10H116	2.00
SM207878245		IC BUS TRANSCVR HCT 245	6.00
SM207960158		IC 2-IN MPX 10H158	16.00
MDX407		IC DEMULTIPLEXER MDX407	8.00
SM207970158		IC 2-IN MPX 74F158A	2.00
208124002		IC VOLT REG -5V UA7905UC	2.00
SM208470324		IC OP AMP LM324M	8.00
208590336		IC VOLT REFERENCE LM336	4.00
208591320		IC NEG VOLT REG LM320	2.00
208591340		IC POS VOLT REG LM340	2.00
SM227060320		IC DIG SIG PROC 320C25	2.00
SM232022822		DIODE ARRAY SCHTTKY 2822	2.00
SM236030099		DIODE SO-PKG BAV99	10.00
SM270030092		TRANSISTOR NPN BFR92	2.00
SM270040092		TRANSISTOR NPN BFR92R	2.00
SM270330848		TRANSISTOR NPN BC848C	4.00
SM270340848		TRANSISTOR NPN 848CR	4.00
SM275030092		TRANSISTOR PNP BFT92	2.00
SM275330858		TRANSISTOR PNP BC858C	4.00
SM275340858		TRANSISTOR PNP 858CR	4.00
280170104		TRANSISTOR FET N VN0104N3	4.00
SM300327102		INDUCTOR WOUND FERRITE 1UH	30.00
309040040		CRYSTAL OSCILLATOR 40MHZ	2.00
400412068		IC SOCKET GRID TYP 68-PIN	2.00
402610002		CONN CO-AX FC MTG SMB	2.00
403181008		HEADER STRT BREAKAW 8-PIN	6.00
405764112		SOCKET SINGLE WIRE 12-POS	2.00
454370002		SHUNT 2 POS	16.00
454610096		HDR DIP SOLD TO MALE 96	2.00
500460006		INSULATOR THERMAFILM	4.00
709450321		HEAT SINK FOR FADC	8.00
550430104		SCREW CYL HD PHIL M3X4	2.00
554900201		SHOULDER WASHER	8.00
585252354		RIVET HOLLOW 2.5X9MM	4.00
SM652101101		RES CHIP (E24) 1% 100 OHM	22.00
SM652101102		RES CHIP (E24) 1% 1 K	8.00
SM652101103		RES CHIP (E24) 1% 10 K	12.00
SM652101112		RES CHIP (E24) 1% 1.1 K	4.00
SM652101122		RES CHIP (E24) 1% 1.2 K	22.00
SM652101132		RES CHIP (E24) 1% 1.3 K	18.00
SM652101152		RES CHIP (E24) 1% 1.5 K	4.00
SM652101181		RES CHIP (E24) 1% 180 OHM	8.00
SM652101182		RES CHIP (E24) 1% 1.8 K	8.00
SM652101201		RES CHIP (E24) 1% 200 OHM	16.00
SM652101240		RES CHIP (E24) 1% 24 OHMS	16.00
SM652101243		RES CHIP (E24) 1% 24 K	4.00
SM652101271		RES CHIP (E24) 1% 270 OHM	2.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----	-----	-----
SM652101302	RES CHIP (E24) 1% 3 K	12.00
SM652101330	RES CHIP (E24) 1% 33 OHMS	8.00
SM652101470	RES CHIP (E24) 47 OHMS	16.00
SM652101471	RES CHIP (E24) 1% 470 OHM	10.00
SM652101510	RES CHIP (E24) 1% 51 OHMS	16.00
SM652101562	RES CHIP (E24) 1% 5.6 K	8.00
SM652101621	RES CHIP (E24) 1% 620 OHM	2.00
SM652101681	RES CHIP (E24) 1% 680 OHM	2.00
SM652101682	RES CHIP (E24) 1% 6.8 K	8.00
SM652101910	RES CHIP (E24) 1% 91 OHMS	24.00
SM652101911	RES CHIP (E24) 1% 910 OHM	10.00
SM661127104	CAP CERA CHIP 20% .1 UF	114.00
SM661207103	CAP CERA CHIP 20% .01UF	250.00
SM666237476	CAP MOLD TANT CHIP 47 UF	18.00
SM666247106	CAP MOLD TANT CHIP 10 UF	12.00
709450301	SPACER	B 2.00
709450311	HEAT SINK	E 2.00
719450313	PC BD PREASS'Y 9450-3A	D 2.00
HMS403-S	4-CH SAMP/HOLD HMS403-S ITI	B 2.00
MNX401	ICMIN MAX GATEARR. MNX401	2.00
402912077	MOUNTING INSULATOR SMB	2.00
405764108	SOCKET SINGLE WIRE 8-POS	2.00
400410046	IC SOCKET GRID TYP 46	8.00
385351009	INSULATING STOCK	2.00
CH599011061	ADHESIVE (THERMAL COND) 709	0.16
SM654101000	CHIP JUMPER ZERO OHMS	4.00
SM661255015	CAP CERA CHIP 1.5 PF	2.00
SM661255033	CAP CERA CHIP 3.3 PF	2.00
SM661255056	CAP CERA CHIP 5.6 PF	2.00
550430106	SCREW CYL HD PHIL M3X6	8.00
709424941	SCREW FOR SELECTOR COVER	A 4.00
709450331	SPIRAL SPRING	A 4.00
709450341	SPRING CONTACT	A 2.00
551430300	WASHER SHAKEPROOF M3	2.00
F9450-4	COMPLETED BOARD F9450-4	C 1.00
103336474	CAP CERA MOND 50V .47UF	1.00
SM158043006	CAP VARIABLE 2 - 6 PF	2.00
SM158043020	CAP VARIABLE 4.5-20 PF	2.00
SM158044010	CAP VARIABLE 3-10PF	3.00
190042221	RESISTOR NETWORK 220 OHMS	2.00
190042563	RESISTOR NETWORK 56K	1.00
190642221	RESISTOR NETWORK 220 OHMS	3.00
190642332	RESISTOR NETWORK 3.3 K	1.00
190642471	RESISTOR NETWORK 470 OHMS	2.00
190642562	RESISTOR NETWORK 5.6 K	4.00
SM200160101	IC OR/NOR GATE 10H101	2.00
SM200160402	IC 16-BIT SCALER MCT402	6.00
SM200167102	IC NOR GATE 10H102	5.00



CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----	-----	-----
SM200167104	IC 2-IN AND GATE 10H104	2.00
SM200167107	IC 2-IN EXCL OR/NOR10H107	3.00
SM200167109	IC 4-5 IN OR/NOR 10H109	1.00
SM200167117	IC OR-AND/D-A-INV 10H117	1.00
SM200167121	IC OR-AND/D-A-INV 10H121	4.00
SM200167131	IC M-S TYP D FLOP 10H131	20.00
SM200172008	IC AND GATE 74F08	1.00
SM200172011	IC 3-INPUT AND 74F11	1.00
SM200172074	IC D-TYP FLOP 74F74	3.00
SM200172113	IC J-K TYP FLOP 74F113	1.00
SM200172374	IN D-TYP FLOP 74F374	3.00
SM200178000	IC 2-INPUT NAND HCT00	2.00
SM200178574	IC D-TYP FLOP HCT 574	8.00
SM200267016	IC BINARY COUNTER 10H016	3.00
SM200278040	IC COUNTER HCT4040	3.00
SM200478573	IC D-TYP LATCH 74HCT573	6.00
205752168	IC AND-OR GATE ARRAY 16L8	2.00
SM207160192	IC BUS DRIV MC10192	1.00
SM207171488	IC QUAD LINE DRIVER 1488	1.00
207281703	IC MONO DAC 16 BIT 703JP	1.00
SM207360125	IC TRANSLATO MC10125	4.00
SM207460116	IC LINE RECEIVER 10H116	10.00
SM207878245	IC BUS TRANSCVR HCT 245	2.00
208124003	IC VOLT REG NEG LM320T-12	1.00
SM208400003	IC RF/IF AMPLIFIER MAR-3	1.00
208570812	IC VOLT REG +12V LM7812CT	1.00
SM232120070	DIODE ARRAY BAV70	4.00
SM236030099	DIODE SD-PKG BAV99	9.00
SM270030019	TRANSISTOR NPN BFS19	3.00
SM270030020	TRANSISTOR NPN BFS20	1.00
SM270030092	TRANSISTOR NPN BFR92	8.00
SM270040092	TRANSISTOR NPN BFR92R	3.00
SM270130092	TRANSISTOR NPN BFR92A	1.00
SM270140092	TRANSISTOR NPN BFR92AR	2.00
SM270330848	TRANSISTOR NPN BC848C	4.00
SM270340848	TRANSISTOR NPN 848CR	1.00
SM275030550	TRANSISTOR PNP BF550	7.00
SM275040550	TRANSISTOR PNP BF550R	3.00
SM275330858	TRANSISTOR PNP BC858C	6.00
SM275340858	TRANSISTOR PNP 858CR	3.00
SM280160022	TRANSISTOR FET N-CH BSD22	3.00
SM289240061	TRANSISTOR NPN BCV61	1.00
SM289240062	TRANSISTOR ARRAY BCV62	2.00
290120003	DELAY LINE 3 N-SEC	1.00
290120007	DELAY LINE 7 N-SEC	2.00
300330350	FERRITE CORE	1.00
SM300446150	INDUCTOR .015UH	2.00
SM300446330	INDUCTOR .033 UH	3.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----	-----	-----
SM300546103	INDUCTOR 10 UH	1.00
SM300546151	INDUCTOR .15 UH	1.00
310060012	CRYSTAL 10PPM 12.4031MHZ	1.00
310062100	CRYSTAL 10PPM 100MHZ	1.00
402610002	CONN CO-AX PC MTG SMB	4.00
403181008	HEADER STRT BREAKAW 8-PIN	1.00
454340002	HDR MALE PIN TO WW 02	2.00
454610096	HDR DIP SOLD TO MALE 96	1.00
554435401	RIVET "RIVSCREW" M 3.5	2.00
585252354	RIVET HOLLOW 2.5X9MM	2.00
SM652101101	RES CHIP (E24) 1% 100 OHM	12.00
SM652101102	RES CHIP (E24) 1% 1 K	13.00
SM652101103	RES CHIP (E24) 1% 10 K	18.00
SM652101112	RES CHIP (E24) 1% 1.1 K	2.00
SM652101122	RES CHIP (E24) 1% 1.2 K	2.00
SM652101161	RES CHIP (E24) 1% 160 OHM	9.00
SM652101180	RES CHIP (E24) 1% 18 OHMS	30.00
SM652101182	RES CHIP (E24) 1% 1.8 K	1.00
SM652101202	RES CHIP (E24) 1% 2 K	8.00
SM652101222	RES CHIP (E24) 1% 2.2 K	6.00
SM652101223	RES CHIP (E24) 1% 22 K	1.00
SM652101270	RES CHIP (E24) 1% 27 OHMS	1.00
SM652101272	RES CHIP (E24) 1% 2.7 K	4.00
SM652101301	RES CHIP (E24) 1% 300 OHM	3.00
SM652101302	RES CHIP (E24) 1% 3 K	3.00
SM652101330	RES CHIP (E24) 1% 33 OHMS	3.00
SM652101332	RES CHIP (E24) 1% 3.3 K	5.00
SM652101362	RES CHIP (E24) 1% 3.6 K	5.00
SM652101510	RES CHIP (E24) 1% 51 OHMS	9.00
SM652101512	RES CHIP (E24) 1% 5.1 K	6.00
SM652101560	RES CHIP (E24) 1% 56 OHM	2.00
SM652101562	RES CHIP (E24) 1% 5.6 K	20.00
SM652101622	RES CHIP (E24) 1% 6.2 K	24.00
SM652101681	RES CHIP (E24) 1% 680 OHM	27.00
SM652101820	RES CHIP (E24) 1% 82 OHMS	47.00
SM652101821	RES CHIP (E24) 1% 820 OHM	41.00
SM652101822	RES CHIP (E24) 1% 8.2 K	2.00
SM661127104	CAP CERA CHIP 20% .1 UF	2.00
SM661186180	CAP CERA CHIP 10% 18 PF	2.00
SM661186470	CAP CERA CHIP 10% 47 PF	2.00
SM661207102	CAP CERA CHIP 10% .001UF	10.00
SM661207103	CAP CERA CHIP 20% .01UF	114.00
SM661250047	CAP CERA CHIP 4.7 PF	3.00
SM661250082	CAP CERA CHIP .1% 8.2 PF	4.00
SM661255100	CAP CERA CHIP 10PF	1.00
SM661255101	CAP CERA CHIP 5% 100 PF	2.00
SM661255181	CAP CERA CHIP 5% 180 PF	1.00
SM661255221	CAP CERA CHIP 5% 220 PF	1.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----		
SM661255330	CAP CERA CHIP 5% 33 PF	2.00
SM661255332	CAP CERA CHIP 5% 3300 PF	1.00
SM661255560	CAP CERA CHIP 56PF	9.00
SM666247106	CAP MOLD TANT CHIP 10 UF	6.00
719450403	PC BD PREASS'Y 9450-4	D 1.00
719450423	PC BD PREASS'Y 9450-42	C 2.00
719450433	PC BD PREASS'Y 9450-43	C 4.00
780390008	TRANSFO FOR 9450-4	1.00
HCD404	HYB CLOCK DIVIDER HCD404	1.00
HTD405	HYBID TIME DIGIT. HTD405	A 1.00
SM652101123	RES CHIP (E24) 1% 12 K	1.00
SM652101121	RES CHIP (E24) 1% 120 OHM	5.00
SM652101151	RES CHIP (E24) 1% 150 OHM	13.00
SM652101162	RES CHIP (E24) 1% 1.6 K	2.00
SM652101181	RES CHIP (E24) 1% 180 OHM	4.00
SM652101201	RES CHIP (E24) 1% 200 OHM	16.00
SM652101221	RES CHIP (E24) 1% 220 OHM	8.00
SM652101271	RES CHIP (E24) 1% 270 OHM	21.00
SM652101331	RES CHIP (E24) 1% 330 OHM	17.00
SM652101391	RES CHIP (E24) 1% 390 OHM	2.00
SM652101470	RES CHIP (E24) 47 OHMS	36.00
SM652101471	RES CHIP (E24) 1% 470 OHM	50.00
SM652101680	RES CHIP (E24) 1% 68 OHMS	3.00
SM653125033	RES THICK FILM 5% 3.3 OHM	3.00
SM661255270	CAP CERA CHIP 27PF	5.00
690000000	PINS/CLIP ON	6.00
690681001	PIN EDGE CLIP STRAIGHT	36.00
719450413	PC BD PREASS'Y 9450-41	2.00
F9450-5	COMPLETED BOARD F9450-5	1.00
103307103	CAP CERA MOND 50V .01 UF	4.00
103427104	CAP CERA MOND 100V .1 UF	10.00
142824685	CAP TANT DIP CASE 6.8 UF	1.00
161225121	RES COMP 1/8W 5% 120 OHMS	16.00
168531365	RES PREC RN55D 511 OHMS	2.00
168531381	RES PREC RN55D 750 OHMS	1.00
168531521	RES PREC RN55D 21.5 K	1.00
169416473	RESISTOR DISC NTC 47 K	1.00
184417502	RES VARI COND PLASTIC 5 K	8.00
184427502	RES VARI COND PLASTIC 5 K	2.00
184437502	RES VARI COND PLASTIC 5 K	2.00
190001001	RES NETWORK SPECIAL	1.00
200344138	IC DECODER 3T08 74HCT138	1.00
205644094	IC 8-BIT SHIFT REGHCT4094	5.00
205752168	IC AND-OR GATE ARRAY 16L8	1.00
207345051	IC MUX/DEMUX HCT4051	3.00
208590385	IC VOLT REF LM385	1.00
230020062	DIODE SWITCHING BAW62	53.00
256243300	DIODE LED RED HLMP-0300	2.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: B

COMPONENT PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----		
256443421	DIODE LED YEL HLMP-0421	39.00
403950002	POLARIZING KEY	2.00
412001012	SWITCH ROT N/STOP 12-PINS	4.00
416161002	SWITCH PUSHBUTTON SPST	47.00
454211020	HDR SOLD TAIL TO MALE 20	1.00
550430106	SCREW CYL HD PHIL M3X6	8.00
551430300	WASHER SHAKEPROOF M3	8.00
553230108	SPACER HEX M3X8MM	4.00
709400511	LED COVER 9400-5	A 41.00
709450511	CALIBR.TERMIN. 9450-5	2.00
709450523	PUSH SWITCH EXTENDER	C 47.00
719450513	PC BD PREASS'Y 9450-5A	1.00
719450523	PC BD PREASS'Y 9450-5B	1.00
HPC411AIH	PROBE CALIBRATOR	A 1.00
SM208470358	IC DUAL OP AMP 358D	1.00
SM232022822	DIODE ARRAY SCHTTKY 2822	1.00
SM275030092	TRANSISTOR PNP BFT92	1.00
SM275040092	TRANSISTOR PNP BFT92R	1.00
SM652101103	RES CHIP (E24) 1% 10 K	2.00
SM652101106	RES CHIP (E24) 1% 10 MEG	1.00
SM652101470	RES CHIP (E24) 47 OHMS	1.00
SM652101510	RES CHIP (E24) 1% 51 OHMS	2.00
SM652101751	RES CHIP (E24) 1% 750 OHM	1.00
SM653185820	RES THICK FILM 82 OHMS	1.00
SM661207103	CAP CERA CHIP 20% .01UF	2.00
690671001	PIN EDGE CLIP RT ANGLE	8.00
710411003	PC BD PREASS'Y HPC411A	A 0.05
SM666317475	CAP MOLD TANT CHIP 4.7 UF	3.00
142224476	CAP TANT DIP CASE 47UF	1.00
SM652101334	RES CHIP (E24) 1% 330 K	1.00
536068001	KNOB FOR 6MM SHAFT	4.00
536068002	KNOB FOR 3MM SHAFT	2.00
536068003	CAP (FOR KNOB 020-2215)	9.00
536068005	CAP FOR 020-3215 OR -3415	3.00
536068006	CAP FOR 021-1110 OR -2215	2.00
536168001	KNOB FOR 1/8" SHAFT	7.00
536168002	KNOB FOR 1/8" SHAFT	1.00
536168003	KNOB FOR 1/8" SHAFT	2.00
709400501	DISPLAY FRAME 9400-5	1.00
485000060	GROMMET 4.8MM ID/10.2 OD	2.00
552425500	SPEED NUT ID 2.5MM	4.00
729450503	FRONT PANEL 9450-5	1.00
550430106	SCREW CYL HD PHIL M3X6	12.00
551430300	WASHER SHAKEPROOF M3	12.00
F9420-6	COMPLETED BOARD F9420-6	B 1.00
103307103	CAP CERA MOND 50V .01 UF	37.00
103427104	CAP CERA MOND 100V .1 UF	31.00
161225027	RES COMP 1/8W 5% 2.7 OHMS	2.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----			
102412100		CAP CERA DISC 100V 10 PF	1.00
103625151		CAP CERA MONO 100V 150 PF	2.00
102412220		CAP CERA DISC 100V 22 PF	1.00
103506331		CAP CERA MONO 100V 330 PF	1.00
142214156		CAP TANT DIP CASE 15 UF	1.00
146354107		CAP MINI ALUM 20% 100 UF	3.00
147436033		CAP ALUM METAL CAN 33 UF	1.00
161225102		RES 1/8W 5% 1K	6.00
161225103		RES COMP 1/8W 5% 10 K	4.00
161225206		RES CARBON FILM 20 MEG	2.00
161225391		RES COMP 1/8W 5% 390 OHMS	3.00
161225472		RES COMP 1/8W 5% 4.7 K	1.00
168531229		RES PREC RN55D 19.6 OHMS	1.00
168531389		RES PREC RN55D 909 OHMS	1.00
168531401		RES PREC RN55D 1.21 K	1.00
168531449		RES PREC RN55D 3.83 K	1.00
168531585		RES PREC RN55D 100 K	3.00
168531601		RES PREC RN55D 147 K	1.00
168531633		RES PREC RN55D 316 K	1.00
190042103		RESISTOR NETWORK 10 K	4.00
190832220		RESISTOR NETWORK 22 OHMS	1.00
190842102		RES NETWORK 1 K	1.00
200344174		IC HEX D-FLOP 74HCT174	1.00
200430393		IC BIN COUNTER HCT393	2.00
200440390		IC DEC COUNTER 74HCT390	2.00
200480167		IC REAL TIME CLOCK 58167	1.00
205271256		HITACHI HM62256LP-12	2.00
205272064		IC8192X8 RAM 6264LP-10	2.00
205301000		UV E-PROM CMOS 1MBIT	6.00
205640165		IC SHIFT REG HCT165	1.00
205752164		IC AND-OR GATE ARRAY 16R4	4.00
205752168		IC AND-OR GATE ARRAY 16L8	8.00
207367576		IC 8-BIT ADC AD7576	1.00
207472245		IC BUS TRANSVR HCT245	9.00
208011007		IC DUAL OP AMP LM358N	1.00
208517705		IC VOLTAGE REG 7705	1.00
208618212		IC VOLT DETECTOR 8212	1.00
227468020		IC 32-BIT U-PROC 68020	1.00
227668881		IC CO-PROCESSOR 68881	1.00
253010811		DIODE SCHOTTKY BAR HP2811	2.00
256233209		DIODE LED (RED) TIL209A	1.00
230020062		DIODE SWITCHING BAW62	2.00
275110001		TRANSISTOR PNP 2N2907A	1.00
280170104		TRANSISTOR FET N VN0104N3	4.00
309041016		CRYSTAL OSCILLATOR 16MHZ	1.00
310111032		CRYSTAL RESONATOR 32KH	1.00
312660030		BATTERY PC MTG LITH 3V	1.00
400331020		SOCKET IC ST DIP-20	1.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----			
400360028		SOCKET IC ST DIP-28	1.00
400360032		SOCKET IC ST DIP-32	6.00
400411114		IC SOCKET GRID TYP 114PIN	1.00
400412068		IC SOCKET GRID TYP 68-PIN	1.00
400415068		IC SOCKET GRID TYP 68-PIN	1.00
403950002		POLARIZING KEY	2.00
411430002		SWITCH ROCKER PC MTG (4)	1.00
454211020		HDR SOLD TAIL TO MALE 20	1.00
454610096		HDR DIP SOLD TO MALE 96	1.00
585252354		RIVET HOLLOW 2,5X9MM	2.00
719420603		PC BD PREASS'Y 9420-6	1.00
MX401		ICMIN MAX GATEARR. MX401	1.00
227792968		IC RAM CONTROLLER 2968A	1.00
205254256		IC 256 X 4 RAM 424256C	8.00
207172965		IC MEMORY DRIVER 2965	1.00
F9450-7		COMPLETED BOARD F9450-7	G 1.00
124471123		CAP POLYPROP 1% .012 UF	10.00
SM168659489		RES METAL FILM .1% 10 K	7.00
SM185457202		RES VARI CERMET 2 K	1.00
SM185457501		RES VARI CERMET 500 OHMS	1.00
SM200178000		IC 2-INPUT NAND HCT00	1.00
SM200178002		IC 2-INPUT NDR HCT02	1.00
SM200178004		IC HEX INVERTER HCT04	2.00
SM200178008		IC 2-INPUT AND HCT08	1.00
SM200178138		IC 3-8 LINE DECOD HCT 138	2.00
SM200178139		IC 2-TO-4-LINE DEC HCT139	2.00
SM205616094		IC 8-ST.SHIFT REG HCT4094	6.00
SM207171488		IC QUAD LINE DRIVER 1488	6.00
SM207978153		IC 4-INPUT MUX HCT153	1.00
208122002		IC VOLT REG POS UA7805	1.00
208124002		IC VOLT REG -5V UA7905UC	2.00
208144001		IC ADJ POS VOLT REG UA78G	1.00
SM208470007		IC OP AMP OP-07	4.00
208870240		IC CALIBRATOR 24010	1.00
208911881		IC SYNC SEPARATOR 1881	1.00
SM236030099		DIODE SO-PKG BAV99	5.00
SM240050091		DIODE ZENER ZMM9.1	2.00
SM270080054		TRANSISTOR NPN BCX54	2.00
SM270340848		TRANSISTOR NPN 848CR	1.00
SM275080051		TRANSISTOR PNP BCX51	2.00
SM289772003		TRANSISTOR ARRAY 2003	2.00
SM301502001		BEAD (FERRITE CHIP)	14.00
402110300		CONN CO-AX PC MTG BNC	3.00
403950002		POLARIZING KEY	2.00
430440732		RELAY 2 FORM C DPDT	12.00
454150010		HDR SOLD TAIL/PC EDG10	1.00
454211040		HDR SOLD TAIL TO MALE 40	1.00
454340002		HDR MALE PIN TO WW 02	2.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: B

COMPONENT PART NUMBER	DESCRIPTION	QTY IN	
		TOP	R ASSEMB
123456789-----	-----	-----	-----
454340012	HDR MALE PIN TO WW 12	1.00	
500560001	INSULATOR MICA FOR TO-220	4.00	
SM653185182	RES THICK FILM 1.8 K	4.00	
SM653505330	RES THICK FILM 33 OHMS	4.00	
SM661250082	CAP CERA CHIP .1% 8.2 PF	1.00	
SM661255332	CAP CERA CHIP 5% 3300 PF	2.00	
SM661255821	CAP CERA CHIP 5% 820 PF	1.00	
SM661256120	CAP CERA CHIP 10% 12 PF	2.00	
SM661286103	CAP CERA CHIP 10% .01 UF	1.00	
SM661486223	CAP CERA CHIP 10 % .022UF	2.00	
SM661506684	CAP CERA CHIP 10% .68UF	3.00	
719450703	PC BD PREASS'Y 9450-7	1.00	J
780261129	SMB-SMC CABLE 29	2.00	
HAT407	HYBRID ATTENUATOR HAT407	2.00	
HAT408	HYBRID ATTENUATOR HAT408	2.00	
HAT409	HYBRID ATTENUATOR HAT409	2.00	
HTR402-S	HYBRID TRIGGER HTR402-S ITI	3.00	D
HHZ406A	HYBRID AMPLIFIER HHZ406A	3.00	E
HII400A-S	HYB AMP HII400A-S ITI	2.00	B
HIV401A-S	HYB AMP HIV401A-S ITI	2.00	A
SM208470351	IC J-FET OP AMP 351	1.00	
SM208470353	IC DUAL OP AMP 353	9.00	
454312004	HDR MALE PIN TO WW (2X2)4	2.00	
SM661127104	CAP CERA CHIP 20% .1 UF	18.00	
SM666327225	CAP MOLD TANT CHIP 2.2 UF	35.00	
158849010	CAP VARIABLE 1 - 5 PF	2.00	
SM208470082	IC J-FET OP AMP 082C	2.00	
SM240050051	DIDDE ZENER TZM-C-5V1	2.00	
SM661207223	CAP CERA CHIP 20% .022 UF	2.00	
9450-7-SUB	SUBCONTRACTOR BOM	0.00	D
SM652101103	RES CHIP (E24) 1% 10 K	0.00	
SM652101105	RES CHIP (E24) 1% 1 M	0.00	
SM652101200	RES CHIP (E24) 1% 20 OHMS	0.00	
SM652101220	RES CHIP (E24) 1% 22 OHMS	0.00	
SM652101223	RES CHIP (E24) 1% 22 K	0.00	
SM652101334	RES CHIP (E24) 1% 330 K	0.00	
SM652101510	RES CHIP (E24) 1% 51 OHMS	0.00	
SM652101511	RES CHIP (E24) 1% 510 OHM	0.00	
SM652101560	RES CHIP (E24) 1% 56 OHM	0.00	
SM652101561	RES CHIP (E24) 1% 560 OHM	0.00	
SM652101564	RES CHIP (E24) 1% 560 K	0.00	
SM652101624	RES CHIP (E24) 1% 620 K	0.00	
SM652101684	RES CHIP (E24) 1% 680 K	0.00	
SM652101750	RES CHIP (E24) 1% 75 OHMS	0.00	
SM652101751	RES CHIP (E24) 1% 750 OHM	0.00	
SM652101122	RES CHIP (E24) 1% 1.2 K	0.00	
SM652101222	RES CHIP (E24) 1% 2.2 K	0.00	
SM652101301	RES CHIP (E24) 1% 300 OHM	0.00	

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UDM: EA SC: M REV: B

COMPONENT PART NUMBER	DESCRIPTION	QTY IN TOP R ASSEMB
123456789-----	-----	-----
SM652101472	RES CHIP (E24) 1% 4.7 K	0.00
SM652101104	RES CHIP (E24) 1% 100 K	0.00
SM652101203	RES CHIP (E24) 1% 20 K	0.00
SM652101225	RES CHIP (E24) 1% 2.2 MEG	0.00
SM652101243	RES CHIP (E24) 1% 24 K	0.00
SM652101270	RES CHIP (E24) 1% 27 OHMS	0.00
SM652101102	RES CHIP (E24) 1% 1 K	0.00
SM652101823	RES CHIP (E24) 1% 82 K	0.00
SM652101391	RES CHIP (E24) 1% 390 OHM	0.00
SM652101221	RES CHIP (E24) 1% 220 OHM	0.00
SM652101112	RES CHIP (E24) 1% 1.1 K	0.00
SM652101824	RES CHIP (E24) 1% 820 K	0.00
SM652101474	RES CHIP (E24) 1% 470 K	0.00
SM652101101	RES CHIP (E24) 1% 100 OHM	0.00
SM661255470	CAP CERA CHIP 47PF	2.00
SM661255471	CAP CERA CHIP 5% 470 PF	2.00
SM661255151	CAP CERA CHIP 5% 150 PF	2.00
709450771	THERMO-COUPLE 2	A 2.00
SM666317475	CAP MOLD TANT CHIP 4.7 UF	2.00
SM207770201	IC ANALOG SWITCH DG201	4.00
SM661207103	CAP CERA CHIP 20% .01UF	121.00
SM185457502	RES VARI CERMET 5 K	2.00
SM653185221	RES THICK FILM 220 OHMS	3.00
550425106	SCREW CYL HD PHIL M2.5X6	4.00
550425520	SCREW FLAT HD PHIL 2.5X20	12.00
550430105	SCREW CYL HD PHIL M3X5	4.00
709450711	FRONT SHIELD	1.00
709450721	LOWER RF SHIELD	1.00
709450731	UPPER RF SHIELD	1.00
F9450-8	COMPLETED BOARD F9450-8	A 1.00
454150039	HDR SOLD TAIL/PC EDG 39	3.00
719450803	PC BD PREASS'Y 9450-8	1.00
9450-8-SUB	SUBCONTRACTOR BOM	0.00
SM652101180	RES CHIP (E24) 1% 18 OHMS	0.00
F9450-9	COMPLETED BOARD F9450-9	E 1.00
205752168	IC AND-OR GATE ARRAY 16L8	1.00
315040015	POWER SUPPLY 9451-1	1.00
455021018	CONNECTOR PIN (FEMALE)	2.00
455210002	BLOCK FOR CRIMP MALE PIN2	1.00
530409996	FILTER FOR PAPST FAN 4014	1.00
550425505	SCREW FLAT HD PHIL M2.5X5	1.00
550440506	SCREW FLAT HD PHIL M4X6	4.00
551440100	FLAT WASHER M4	4.00
554500001	TAPPING SCREW W/U-THREAD	2.00
709450911	SERIAL NUMBER PLATE	1.00
709450921	VOLT SELECT COVER 9450-9	B 1.00
780249945	BNC-SMD CABLE 45	2.00
780259927	BNC-SMB CABLE 27	2.00



CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: B

		QTY IN TOP R ASSEMB	
COMPONENT PART NUMBER	DESCRIPTION		
123456789-----	-----		
552440300	NUT OPEN-END ACORN M4		4.00
433162400	FUSE SLO-BLO 250V 4 AMP		2.00
433162200	FUSE SLO-BLO 250V 2AMP		2.00
205752164	IC AND-OR GATE ARRAY 16R4		1.00
550440620	SCREW OVAL HD PHIL		4.00
RP9450-9	COMPLETED REAR PANEL 9450-9		1.00
709450901	REAR PANEL F9450-9	E	1.00
530409125	FAN AXIAL 12V DC		1.00
550430105	SCREW CYL HD PHIL M3X5		2.00
M9450	LOOSE PARTS M9450	C	1.00
300090001	DEFLECTION YOKE		1.00
455020001	CONNECTOR PIN (FEMALE)		4.00
455121003	CONNECTOR HOUSING 3		2.00
455950002	CLAMP WITH STRAIN RELIEF		2.00
594120003	TIEWRAP		2.00
321220009	CRT ORANGE 90 DEG DEFL 9"		1.00
377051005	LABEL "DANGER-----ONLY"	A	1.00
512021867	BRACKET RIGHT ANGLE SMALL		2.00
530010024	FOOT FOR COMPAC ENCLOSURE		4.00
530301005	HANDLE (U-SHAPE)		1.00
530410001	CARD GUIDE NON METALLIC		5.00
544310001	SPRING EXT TYPE 190 MM		1.00
550430104	SCREW CYL HD PHIL M3X4		10.00
550430106	SCREW CYL HD PHIL M3X6		18.00
550430120	SCREW CYL HD PHIL M3X20		3.00
550430508	SCREW FLAT HD PHIL M3X8		2.00
550440108	SCREW CYL HD PHIL M4X8		4.00
550440110	SCREW CYL HD PHIL M4X10		6.00
550440416	CYL INT HEX M4X16		4.00
550440640	SCREW OVAL HD PHIL M4X40		4.00
550450108	SCREW CYL HD PHIL M5X8		6.00
551430300	WASHER SHAKEPROOF M3		24.00
551440300	WASHER SHAKEPROOF M4		14.00
551450300	WASHER SHAKEPROOF M5		6.00
552430300	NUT OPEN-END ACORN M3		4.00
552440100	NUT HEX M4		8.00
554040901	NUT GUIDE FOR 554440101		4.00
554440101	NUT SQUARE M4		4.00
554440201	GND WASHER FOR 554440101		1.00
554440202	FLAT WASHER M4		4.00
594120003	TIEWRAP		3.00
594230002	CABLE CLIP ADHESIVE BACK		1.00
709400000	DSD COMPLETED BOX		1.00
709400071	REAR PANEL FOOT	A	4.00
709450001	DISPLAY SUPPORT	D	1.00
709450011	MOTHER CARD SUPPORT	C	1.00
709450021	SPACER	C	1.00
709450031	SUPP.ANGLE BRACKET (REAR)	A	2.00

CLASS CODE: 1  
 FINISHED GOODS-MANUFACTURED  
 PART: 9450  
 DESC: FINAL ASSEMBLY 9450

UOM: EA SC: M REV: B

COMPONENT	PART NUMBER	DESCRIPTION	R	QTY IN TOP ASSEMB
123456789	-----	-----	-----	-----
	709450051	POWER SUPPLY SUPPORT	C	1.00
	709450061	REAR PANEL ANCHOR	B	2.00
	709450071	NEOPRENE WASHER	A	4.00
	780210030	DISPLAY POWER CABLE	A	1.00
	780220015	BASE CARD POWER CABLE	A	1.00
	780231120	FRONT END BASE CABLE	B	1.00
	780299025	CRT CABLE	A	1.00
	780411236	FRONT PANEL CABLE	A	1.00
	551430301	WASHER SHAKEPROOF LGE M3		7.00
ACCESSORIES-9450		ACCESSORIES FOR 9450	A	1.00
P9020		PROBE DC-300MHZ/ATTN 10:1		2.00
597940011		SHIPPING CARTON 9400		1.00
597940012		SHIPPING INSERT 9400		2.00
597940014		PLASTIC BAG FOR 9400		2.00
597940015		MANUAL/ACCESSORY CTN 9400		1.00
589203218		AC CORD/US-CANADA PLUG		0.60
589203100		AC CORD/"SEV-ASE" PLUG		0.05
589202100		AC CORD/PLUG FOR FRANCE		0.10
589202200		AC CORD/PLUG FOR GERMANY		0.15
407099008		PLUG FOR AC LINE -ENGLAND		0.10
433162200		FUSE SLO-BLO 250V 2AMP		2.00
433162400		FUSE SLO-BLO 250V 4 AMP		2.00

## **9450 DIGITAL OSCILLOSCOPE**

### **SERVICE MANUAL**

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